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MUTUAL INTERFERENCE OF MULTIPLE BODIES IN THE FLOW FIELD OF THE F-4C AIRCRAFT IN THE TRANSONIC SPEED RANGE

A. A. Hesketh
ARO, Inc.

December 1979

Final Report for Period 12 - 21 November 1979

ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE STATION, TENNESSEE
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE

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This report has been reviewed and approved.

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FOR THE COMMANDER

John C Hartney

JOHN C. HARTNEY, Colonel, USAF
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
A wind tunnel test was conducted to study the mutual interference of multiple bodies in the flow field of the F-4C aircraft. The test utilized 1/20-scale models of the F-4C aircraft, the MK-83 bomb (with and without fins) and the triple ejector rack (TER) to obtain aerodynamic loads on the MK-83 at, and near, the carriage position on the wing inboard pylon. Flow field data in the vicinity of the TER were also obtained. Test variables included aircraft angle of attack from -3 to 17 deg, freestream Mach number from 0.60 to 0.95, and aircraft configuration. Freestream aerodynamic loads data were also obtained on the MK-83 bomb model.

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NOMENCLATURE

AE	Engine exhaust choke exit area, 7.4662 X 10^{-3} ft^2, model scale
AI	Engine duct inlet area, 1.7050 X 10^{-2} ft^2, model scale
ALPHA	Aircraft model angle of attack relative to the free-stream velocity vector, deg
ALPHAS	Store model angle of attack, deg
APPE	Average measured total pressure at the engine exhaust choke exit plane, psfa
APPE1	Calculated average total pressure at the engine exhaust choke exit plane for supersonic flow, psfa
APSE	Average measured static pressure at the engine exhaust choke exit plane, psfa
BL	Aircraft buttock line from plane of symmetry, in., model scale
CAT	Store model total axial-force coefficient, total axial force/(Q·AM)
CLL	Store model rolling-moment coefficient, rolling moment/Q.AM·L3M
CLM	Store model pitching-moment coefficient, pitching moment/Q·AM·L1M
CLN	Store model yawing-moment coefficient, yawing moment/Q·AM·L2M
CN	Store model normal-force coefficient, normal force/Q·AM
CONFIG	Aircraft model configuration designation
CPE	Difference in pressure coefficient between probe orifices 1 and 3, positive for positive EPS, (PS1 - PS3)/QL
CPS	Difference in pressure coefficient between probe orifices 2 and 4, positive for positive SIG, (PS4 - PS2)/QL

CR	Capture ratio, mass flow rate divided by the theoretical inlet mass flow rate, (see page 12)
CY	Store model side-force coefficient, side force/Q·AM
D	Store model reference diameter, 0.70 in
DPHI	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg
EPS	Indicated angle (in pitch and calculated using CPE) between the projection of the local flow velocity vector onto the probe X_B-Z_B plane and the probe X_B-axis, positive for a velocity-vector component in the negative Z_B direction, deg
FS	Aircraft fuselage station, in., model scale
IP,IY	Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg
L1M	Reference length for pitching-moment coefficient, 0.70 in. model scale
L2M	Reference length for yawing-moment coefficient, 0.70 in model scale
L3M	Reference length for rolling-moment coefficient, 0.70 in model scale
M	Wind tunnel free-stream Mach number
MDOTN	Engine duct mass flow rate, lbm/sec, (see page 12)
MNE	Engine duct exit Mach number, (see page 12)
PS1-PS4,PP5	Measured pressures for probe orifices 1 through 5, respectively, psfa
PT	Wind tunnel total pressure, psfa
Q	Wind tunnel free-stream dynamic pressure, psf
QL	Local dynamic pressure, psf
RE	Wind tunnel free-stream unit Reynolds number, millions per foot

RUN	Data set identification number
SIG	Indicated angle (in yaw and calculated using CPS) between the projection of the local flow velocity vector onto the probe X_B-Y_B plane and the probe X_B-axis, positive for a velocity-vector component in the positive Y_B direction, deg
TT	Wind tunnel total temperature, °F
VR	Velocity ratio, exhaust choke exit velocity divided by freestream velocity, (see page 12)
WL	Aircraft waterline from reference horizontal plane, in., model scale
XCG	Axial distance from the store nose to its center of gravity, 4.2083 ft full scale

Grid Aerodynamic Loads

XP	Separation distance of the store nose with respect to the pylon-axis system origin in the X_P direction, in, model scale
YP	Separation distance of the store nose with respect to the pylon-axis system origin in the Y_P direction, in, model scale
ZP	Separation distance of the store nose with respect to the pylon axis system origin in the Z_P direction, in, model scale

Flow-field Probe

XP	Position of the probe reference point with respect to the probe-axis system origin in the X_P direction, in, model scale
YP	Position of the probe reference point with respect to the probe-axis system origin in the Y_P direction, in, model scale
ZP	Position of the probe reference point with respect to the probe-axis system origin in the Z_P direction, in, model scale

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_B	Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all times. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

PYLON-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

X_P	Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot
Y_P	Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_P	Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

FLIGHT-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The origin of the pylon-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

PROBE BODY-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_B — Parallel to the probe longitudinal axis, positive forward as seen by the pilot

Y_B — Perpendicular to the X_B and Z_B directions, positive to the right as seen by the pilot when the probe is at zero yaw and roll angles

Z_B — Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the probe and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the probe is at zero pitch and roll angles

Origin

The probe reference point is the intersection of the plane containing the four static orifices and the probe centerline. The probe body-axis system origin is coincident with the probe reference point and is fixed with respect to the probe for the duration of the grid set. The X_B, Y_B and Z_B coordinate axes rotate with the probe in pitch, yaw and roll.

PROBE-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_P — Parallel to the probe longitudinal axis at the initialization of the grid set and rotated through pitch and yaw angles of IP and IY, respectively, with respect to the aircraft longitudinal axes positive forward as seen by the pilot

Y_P — Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

Z_P — Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

FLIGHT-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The origin of the probe-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

1.0 INTRODUCTION

The work reported herein was conducted by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), at the request of the Air Force Flight Dynamics Laboratory (AFFDL/FGC), Wright-Patterson AFB, Ohio, for Nielsen Engineering and Research, Inc., Mountain View, California, under Program Element 62201F. The project monitor was Mr. Calvin L. Dyer (AFFDL/FGC). The results of the test were obtained by ARO, Inc., AEDC Division (a Sverdrup Corporation Company), operating contractor for AEDC, AFSC, Arnold Air Force Station, Tennessee, under ARO Project Number P41C-F0 (Test TC-623). The test was conducted from November 12 through 21, 1979, in the Aerodynamic Wind Tunnel (4T).

The objective of this test was to provide aerodynamic data for use in determining the mutual interference of multiple bodies in the flowfield of the F-4C aircraft in the transonic speed range. This information will be used to improve analytic procedures for calculating aerodynamic loads on stores. The test utilized 1/20-scale models of the F-4C aircraft, the MK-83 bomb (with and without fins), and a triple ejector rack (TER) to obtain aerodynamic loads, using the captive loads and CTS grid techniques. Also, during the captive loads phase, a total pressure rake was mounted just aft of the right hand engine exhaust choke of the F-4C aircraft model to determine the mass flow rate through the simulated engine ducting.

The purpose of this report is to document the test and to describe the test parameters. The report provides information to permit the use of the data but does not include any data analysis, which is beyond the scope of this report.

The final data from this test have been transmitted to Nielsen Engineering and Research, Inc., Mountain View, California, and the Air Force Flight Dynamics Laboratory (AFFDL/FGC). Requests for the data should be addressed to AFFDL/FGC, Wright-Patterson AFB, Ohio 45433. A copy of the final data is on file on microfilm at AEDC.

2.0 APPARATUS

2.1 TEST FACILITY

The Aerodynamic Wind Tunnel (4T) is a closed-loop, continuous flow, variable-density tunnel in which the Mach number can be varied from 0.1 to 1.3 and can be set at discrete Mach numbers of 1.6 and 2.0 by placing nozzle inserts over the permanent sonic nozzle. The

nominal range of the stagnation pressure can be varied from 400 to 3,400 psfa. The test section is 4 ft square and 12.5 ft long with perforated, variable porosity (0.5- to 10-percent open) walls. It is completely enclosed in a plenum chamber from which the air can be evacuated, allowing part of the tunnel airflow to be removed through the perforated walls of the test section. A more complete description of the test facility may be found in Ref. 1.

For this test, two separate and independent support systems were used. The aircraft model was installed inverted in the test section and was supported by an offset sting attached to the main pitch sector. For captive loads testing, the store model was mounted on a balance fastened to the bottom station of the TER on the aircraft model. For grid aerodynamic loads and flow-field testing the store model or the flow-field probe was mounted on the captive trajectory support (CTS). The aircraft model was removed when obtaining free-stream data, and the CTS was moved upward (and downstream) in the tunnel during the captive loads phase to minimize interference. Isometric drawings of typical captive loads, grid survey, and flow-field testing are shown in Fig. 1, along with block diagrams of the computer control loops. Schematics showing the test section details and the location of the models in the tunnel are shown in Fig. 2. Further description of the CTS rig can be found in Ref. 1.

2.2 TEST ARTICLES

The basic details of the 1/20-scale F-4C model are presented in Fig. 3. The model is geometrically similar to the full-scale aircraft except that the tail section was removed to minimize interference with the CTS movement. The F-4 model has flow-through engine inlets and interchangeable nose sections. All testing was accomplished with the F-4C nose configuration. Details and dimensions of the F-4C pylons are given in Fig. 4. The triple ejector rack (TER) model was made with ventilation passages and sway braces to more closely simulate the full scale version. Details and dimensions of the TER model are given in Fig. 5. A total pressure rake, containing 13 total pressure orifices, was mounted just aft of the right hand engine exhaust choke of the F-4C aircraft model. The interior surface of the exhaust choke contained six static pressure orifices. Details and dimensions of the total pressure rake and exhaust choke are given in Fig. 6. Details and dimensions of the MK-83 bomb models are given in Fig. 7. The afterbody of the MK-83 bomb model was modified to allow for sting mounting on the CTS. The modified and the actual afterbody were tested during the captive loads phase. The MK-83 model was also tested with and without tail fins during the captive loads and grid survey phases.

The pressure probe which was used to obtain the flow-field measurements consisted of a single cone-cylinder with a 40-deg included angle tip. There were four equally spaced static pressure orifices on the surface of the cone and a total pressure orifice at the apex of the cone. Details of the probe are shown in Fig. 8.

Tunnel installation of typical test configurations is shown in Fig. 9.

2.3 INSTRUMENTATION

A six-component, internal strain-gage balance was used to measure the aerodynamic forces and moments acting on the MK-83 bomb model. For the captive loads testing, the balance was supported by a bracket attached to the TER. A sketch of the store, balance, and TER assembly is shown in Fig. 10. For grid survey testing the balance was sting mounted to the CTS.

All pressures were measured using ±15-psid transducers. Translational and angular positions of the store or pressure probe were obtained from the CTS analog outputs. The aircraft model angle of attack was set using an internal gravimetric angular position indicator. The TER contained a mechanical touch wire to provide accurate setting of the store or pressure probe at the reference position for each survey. The system was also electrically connected to automatically stop the CTS movement if the probe or CTS contacted the model, sting support, or test section walls.

3.0 TEST DESCRIPTION

3.1 TEST CONDITIONS

Data were obtained at Mach numbers from 0.60 to 0.95 at a constant Reynolds number of 3.5 million per foot. The aircraft model angle of attack was varied from -3 to 17 deg during the captive loads testing and from 1 to 17 deg during the grid aerodynamic loads and flow-field survey testing. The nominal wind tunnel test conditions are presented in Table 1. Tunnel conditions were held constant at the desired settings while data for each captive aerodynamic loads sweep, grid aerodynamic loads survey, and flow-field survey were obtained.

3.2 DATA ACQUISITION AND REDUCTION

3.2.1 Captive Aerodynamic Loads Data

The carriage aerodynamic loads data were obtained at aircraft model angles of attack from -3 to 17 deg at 0 deg sideslip angle. The CTS was moved upward (and downstream) in the test

section to minimize its influence on the aircraft flow field. All pitch polars were run automatically utilizing online computer facilities to calculate the control commands to set the aircraft model attitude. The force and moment data for the store were reduced to coefficient form in the body axis system and the moment data were referenced to the MK-83 center-of-gravity location (XCG). Exit Mach number, mass flow rate, captive area ratio, and a velocity ratio for the right hand engine duct were calculated from the following equations using the measured total pressures from the total pressure rake, the static pressure located in the exhaust choke, and the tunnel freestream conditions.

$$MNE = \{5[(APPE/APSE)^{2/7}-1]\}^{1/2} \tag{1}$$

$$MDOTN = APPE \cdot MNE \cdot AE \cdot [1+0.2(MNE)^2]^{-3} \cdot [0.8843/(TT+459.6)]^{1/2} \tag{2}$$

$$CR = MDOTN/\{PT \cdot M \cdot AI \cdot [1+0.2(MNE)^2]^{-3} \cdot [0.8843/(TT+459.6)]^{1/2}\} \tag{3}$$

$$VR = (MNE/M) \cdot [(1+0.2(M)^2)/(1+0.2(MNE)^2)]^{1/2} \tag{4}$$

If the static-to-total pressure ratio (APSE/APPE) was less than 0.5283, indicating that the exit flow was supersonic, the exit Mach number (MNE) was determined by iteration of the Rayliegh-Pitot Formula (Eq. 5 below). The total pressure upstream of the rake shock wave was then calculated by Eq. 6, and this value was used instead of the measured total pressure value (APPE) in Eq. 2.

$$(APPE/APSE) = [(6/5) \cdot MNE^2]^{7/2} \cdot [6/(7 \cdot (MNE)^2-1)]^{5/2} \tag{5}$$

$$APPE1 = APSE \cdot [1+0.2(MNE)^2]^{7/2} \tag{6}$$

The rake and choke pressures were processed through an automatic pressure settling routine and were recorded and tabulated only after a prescribed convergence criterion (pressure change less than 2 psf/sec) was met.

3.2.2 Grid Aerodynamic Loads Data

To obtain store aerodynamic loads data, test conditions were first established in the tunnel. Operational control of the model support systems was then switched to the digital computer. For free-stream data, the computer would initially position the store at ALPHAS = 0 through commands to the CTS (see block diagram, Fig. 1). For data in the aircraft flow field, the computer would position the aircraft model at the desired angle of attack and then position the store at a known location and orientation with respect to the

aircraft model. After initial-point data were recorded, the digital computer then positioned the store at preselected orientations and positions programmed into the computer. At each set position, the wind tunnel operating conditions and the store model forces and moments were measured and recorded. The model aerodynamic loads were then reduced to coefficient form and tabulated by the digital computer. The aerodynamic moments were reduced about the XCG location of the store. Grid aerodynamic loads in the aircraft flow field were measured along vertical traverses as shown in Table 2. Freestream aerodynamic loads data were measured at store angles of attack from -4 to 16 deg. The Mach number was varied from 0.60 to 0.95.

3.2.3 Flow-field Survey Data

During the test, flow-field probe data were obtained in the following manner. After tunnel conditions and aircraft model angle of attack were set, operational control of the CTS was switched to the digital computer. The computer then positioned the probe at a known location and orientation with respect to the aircraft model through commands to the CTS. After initial point data were recorded, the probe was automatically positioned at preselected positions and orientations programmed into the computer. The probe pressures were processed through an automatic pressure settling routine and were recorded and tabulated only after a prescribed convergence criterion (pressure change less than 2 psf/sec) was met. Flow-field survey data in the aircraft flow field were measured along XP traverses at constant YP and ZP values as shown in Table 3.

3.3 CORRECTIONS

Balance, sting, and support deflections caused by the aerodynamic loads on the store models during the captive and grid aerodynamic loads testing were accounted for in the data reduction program to calculate the true store-model angles and positions. Corrections were also made for model weight tares to calculate the net aerodynamic forces on the store model.

3.4 UNCERTAINTY/PRECISION OF MEASUREMENTS

Uncertainties in the basic tunnel parameters, PT, TT and M, were estimated from repeat calibrations of the instrumentation and from repeatability and uniformity of the test section flow during tunnel calibration. These uncertainties were then used to estimate the uncertainties in other free-stream properties, using the Taylor series method of error propagation (Ref. 2). The balance uncertainties, based on a 95-percent confidence level, were combined with the uncertainties in the tunnel parameters, assuming a Taylor series

error propagation, to estimate the precision of the aerodynamic coefficients. The maximum estimated uncertainties are given in Table 4. The uncertainties in the flow field data were calculated considering probable inaccuracies in the pressure measurements and tunnel conditions. These estimated uncertainties are also shown in Table 4.

The estimated uncertainties in store model and pressure probe positioning from the ability of the CTS to set on a specified value were ±0.050 in model scale in X, Y, and Z, ±0.15 deg in pitch and yaw, and ±1.0 deg in roll settings. Estimated uncertainty in aircraft model angle of attack is ±0.15 deg. The Mach number was held constant within ±0.005 of the quoted Mach number with an estimated uncertainty of ±0.003.

Examples of data repeatability are shown in the plots of Fig. 11.

4.0 DATA PRESENTATION

The data package consists of tabulated summary data, microfilm of the summary data, model installation photographs, and computer-generated plots of the flow field data.

A test run number summary is presented in Table 5 correlating the model configurations and the test conditions with the test data run number. Configuration identifications are shown in Table 6.

Data tabulation formats for the captive aerodynamic loads phase and nomenclature for these data are presented in Tables 7 and 8, respectively. The data tabulation format for the grid aerodynamic loads phase and nomenclature for these data are presented in Tables 9 and 10, respectively. The data tabulation format for the flow-field survey phase and nomenclature are presented in Tables 11 and 12, respectively. Online plotting capability was also available through an interactive graphics system, and some examples are shown in Figure 12.

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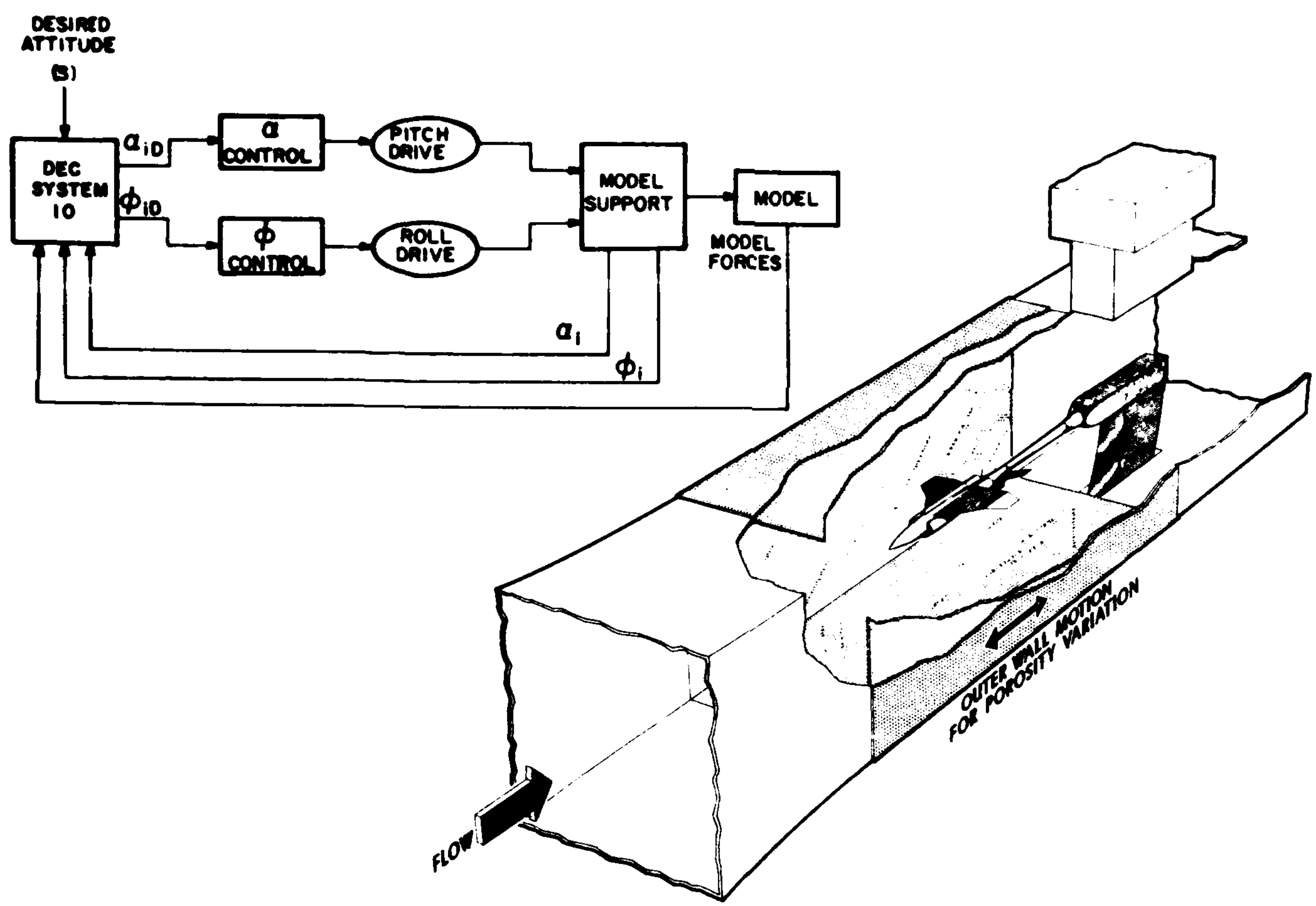
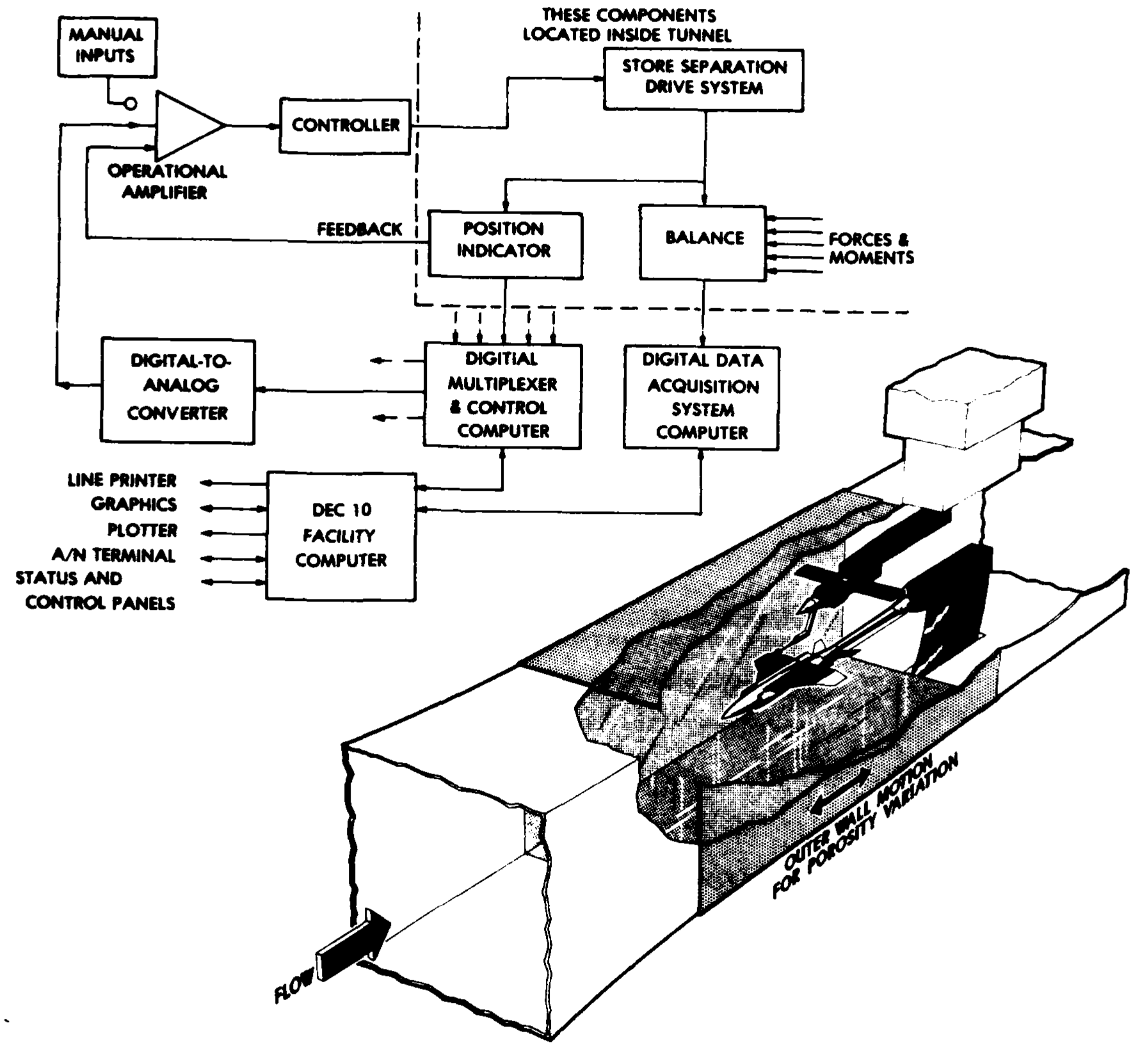
1. Test Facilities Handbook (Eleventh Edition). "Propulsion Wind Tunnel Facility, Vol. 4." Arnold Engineering Development Center, June 1979.

2. Beers, Yardley. Introduction to the Theory of Error. Addison Wesley Publishing Company, Inc., Reading, MA, 1957, pp. 26-36.



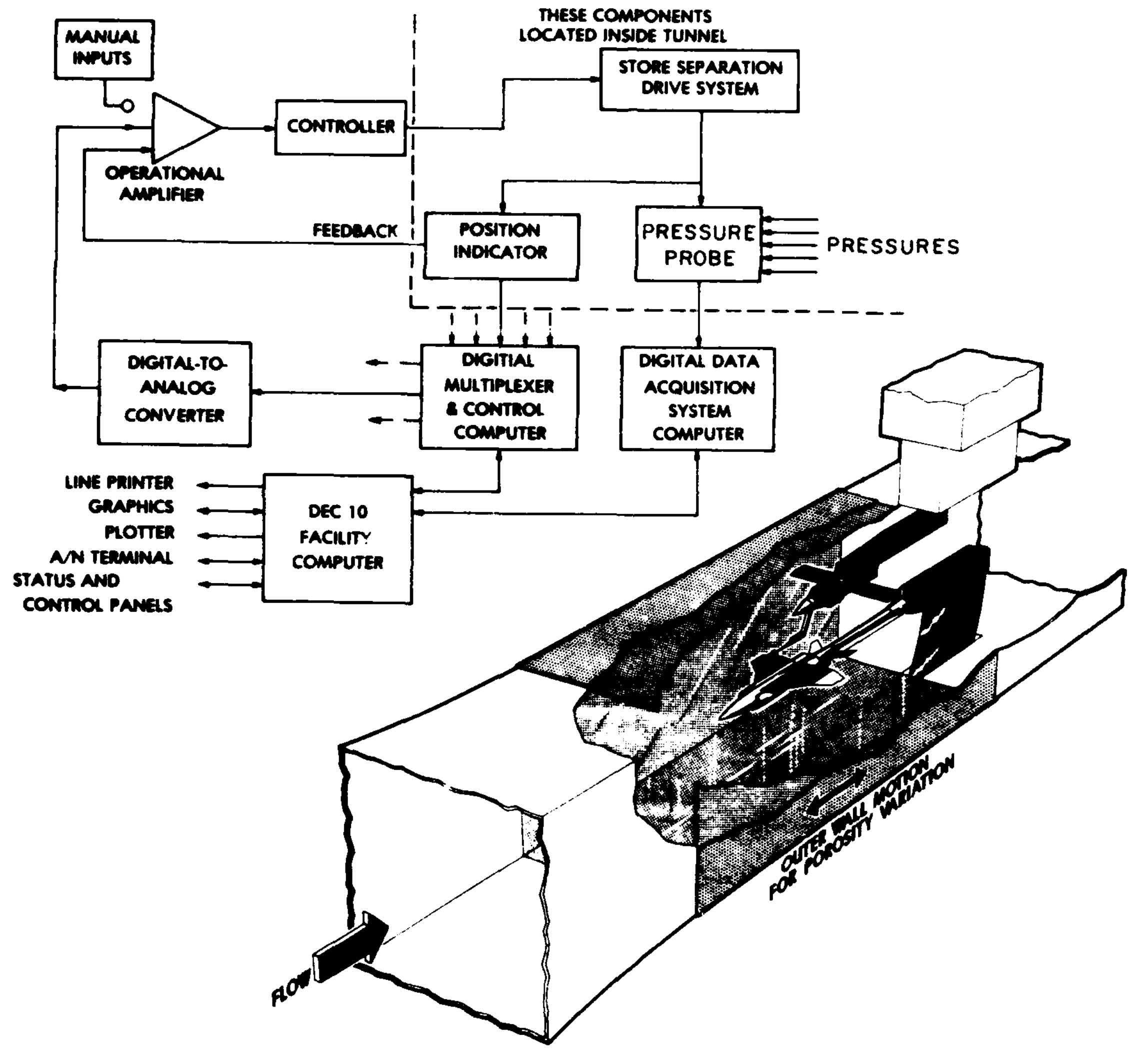
a. Captive Loads Phase

Figure 1. Isometric Drawings of Typical Installations and Block Diagrams of the Computer Control Loops



b. Grid Phase

Figure 1. Continued



c. Flow-Field Phase

Figure 1. Concluded

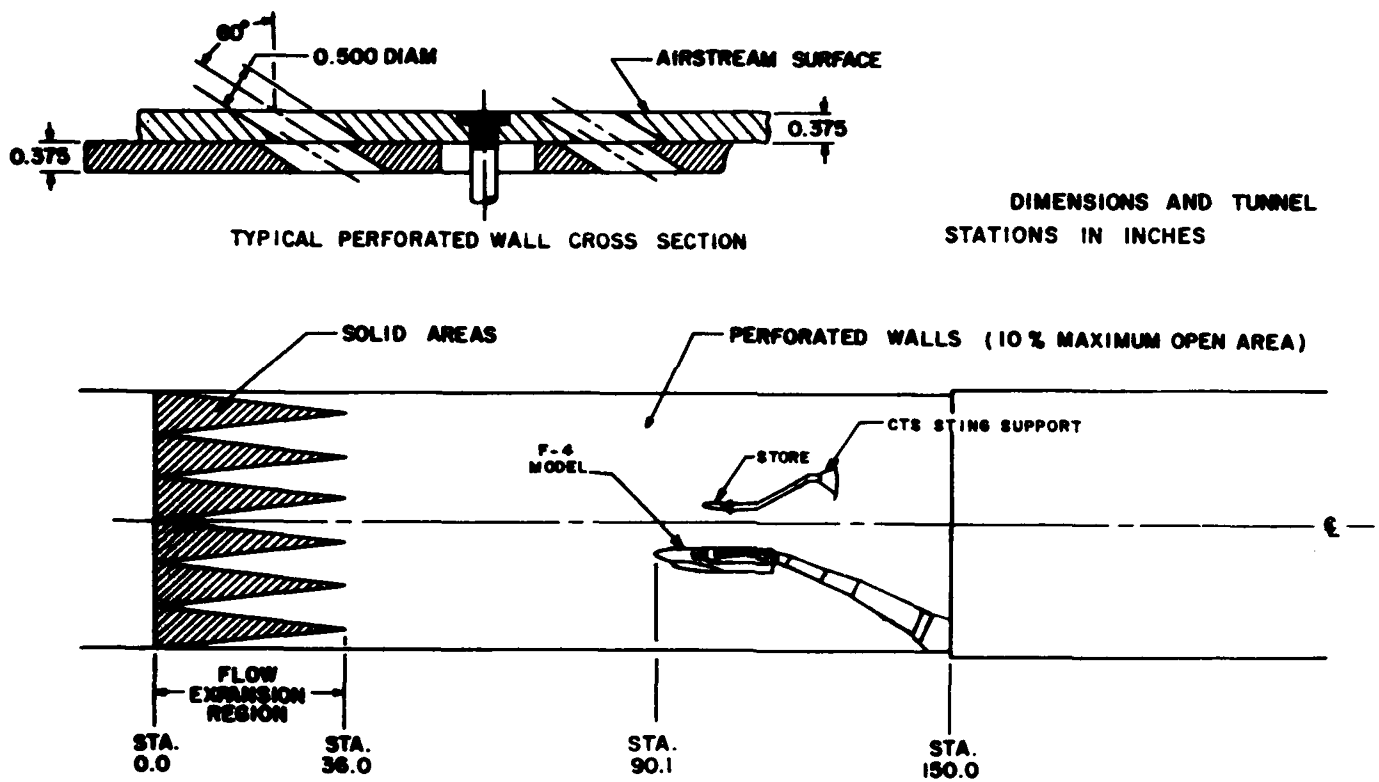


Figure 2. Schematic of the Test Installation

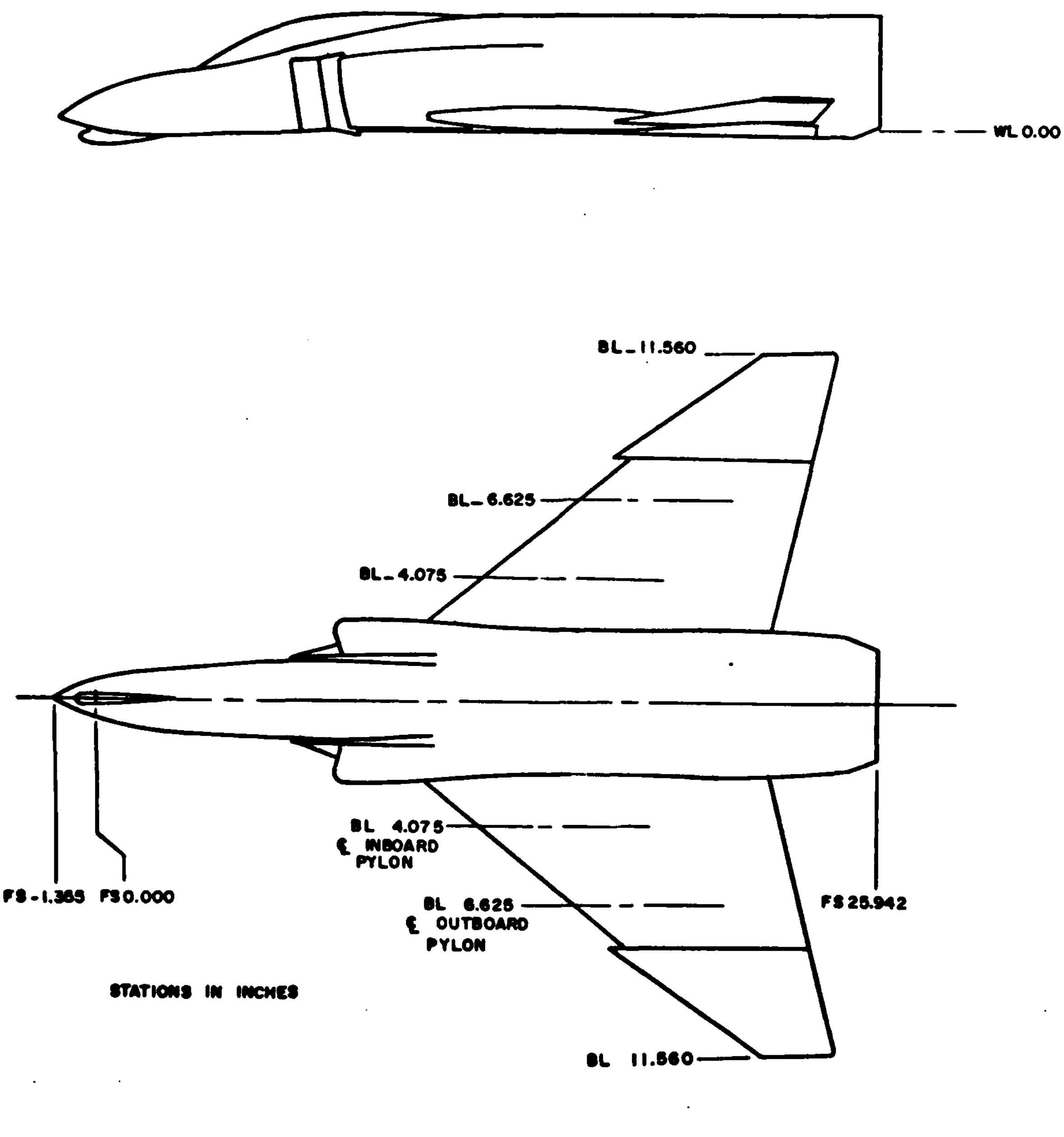


Figure 3. F-4C Aircraft Model

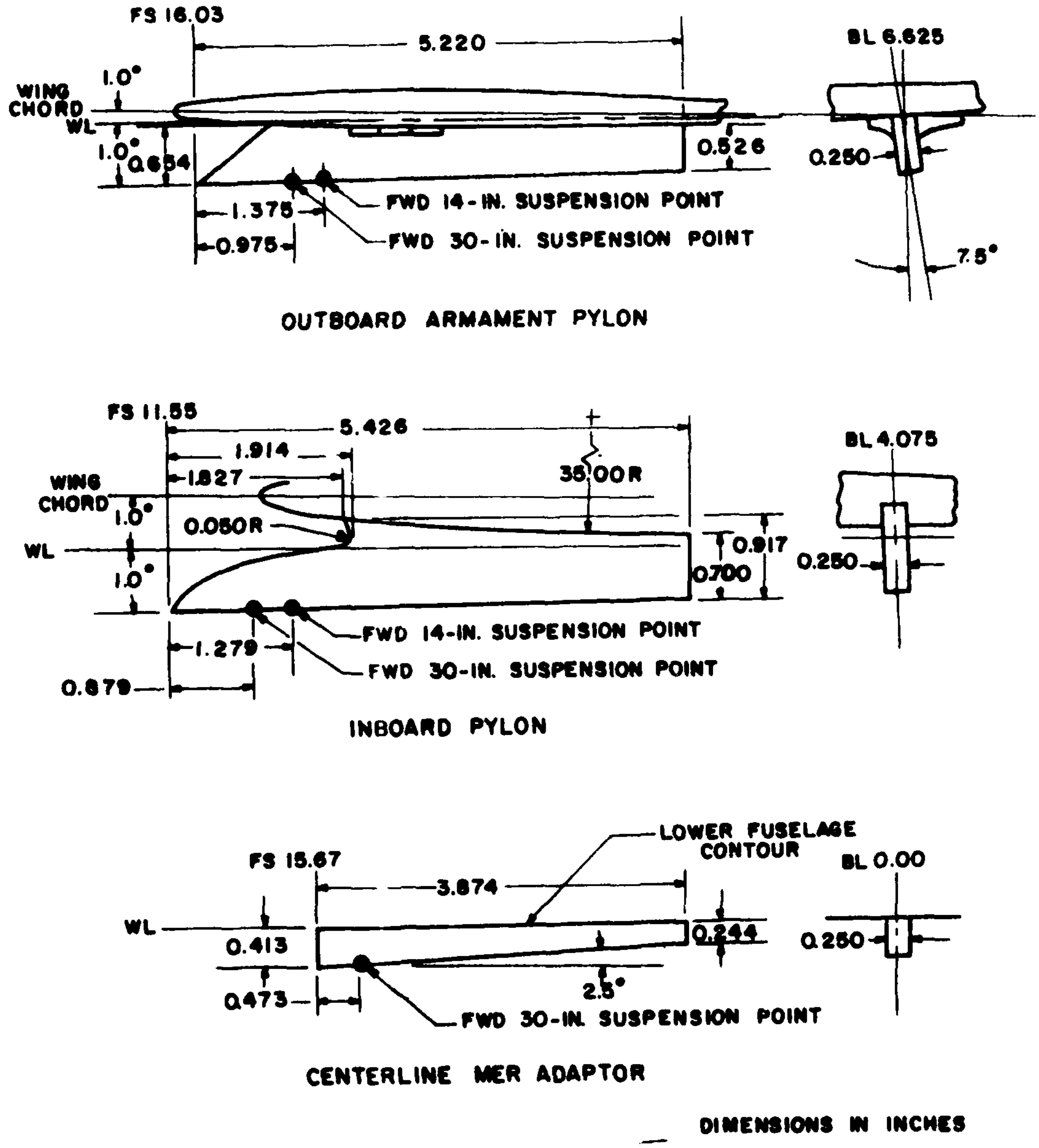


Figure 4. F-4C Pylon Models

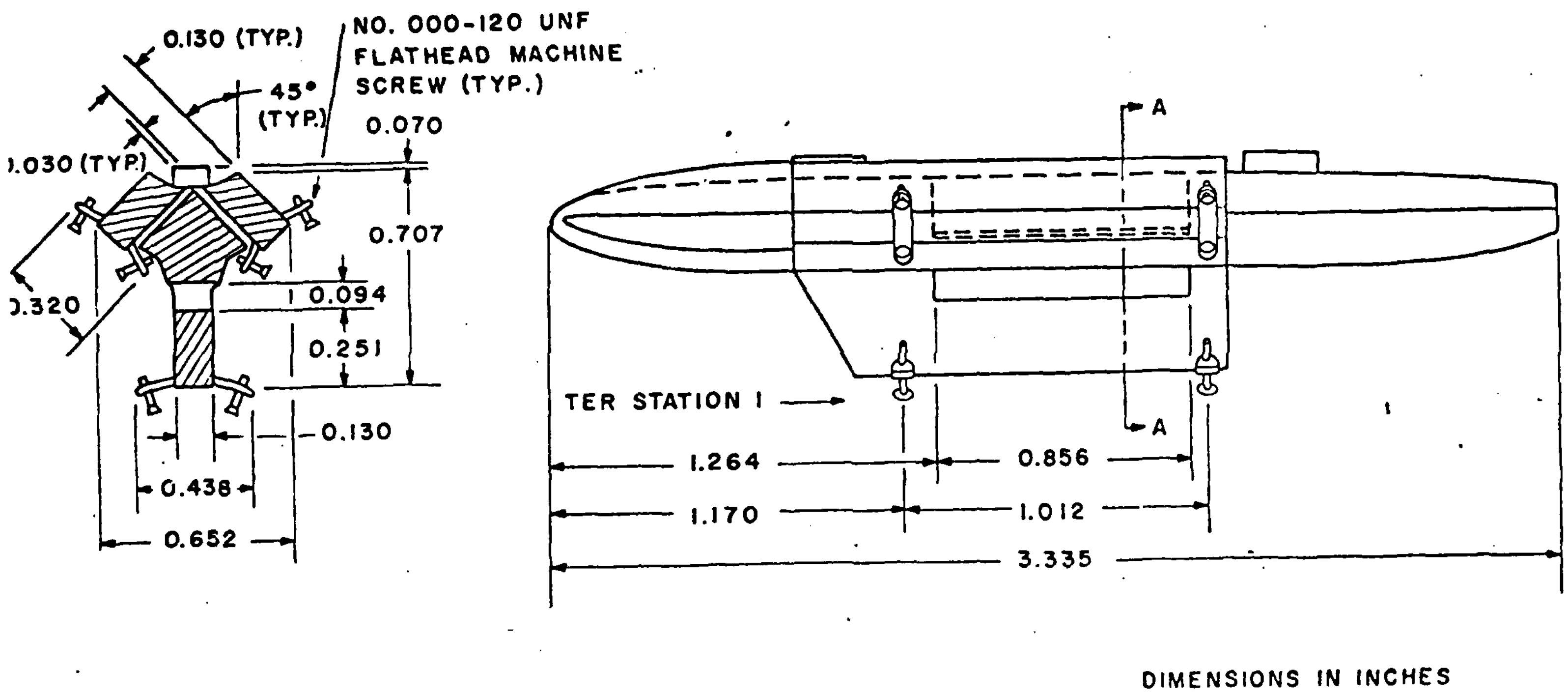
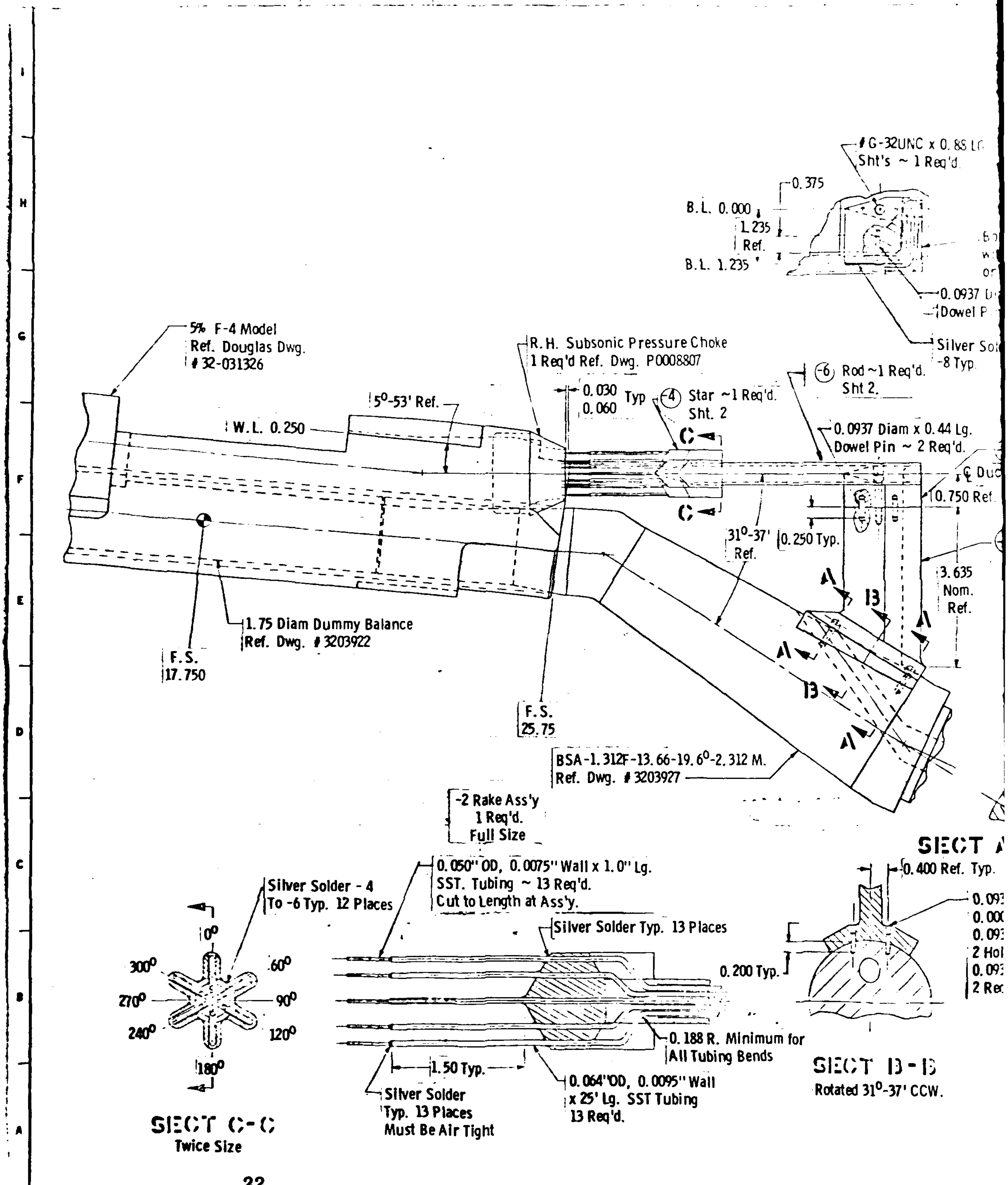


Figure 5. Modified Triple Ejector Rack Model



G-32UNC x 0.85 Lg.
Sht's ~ 1 Req'd.
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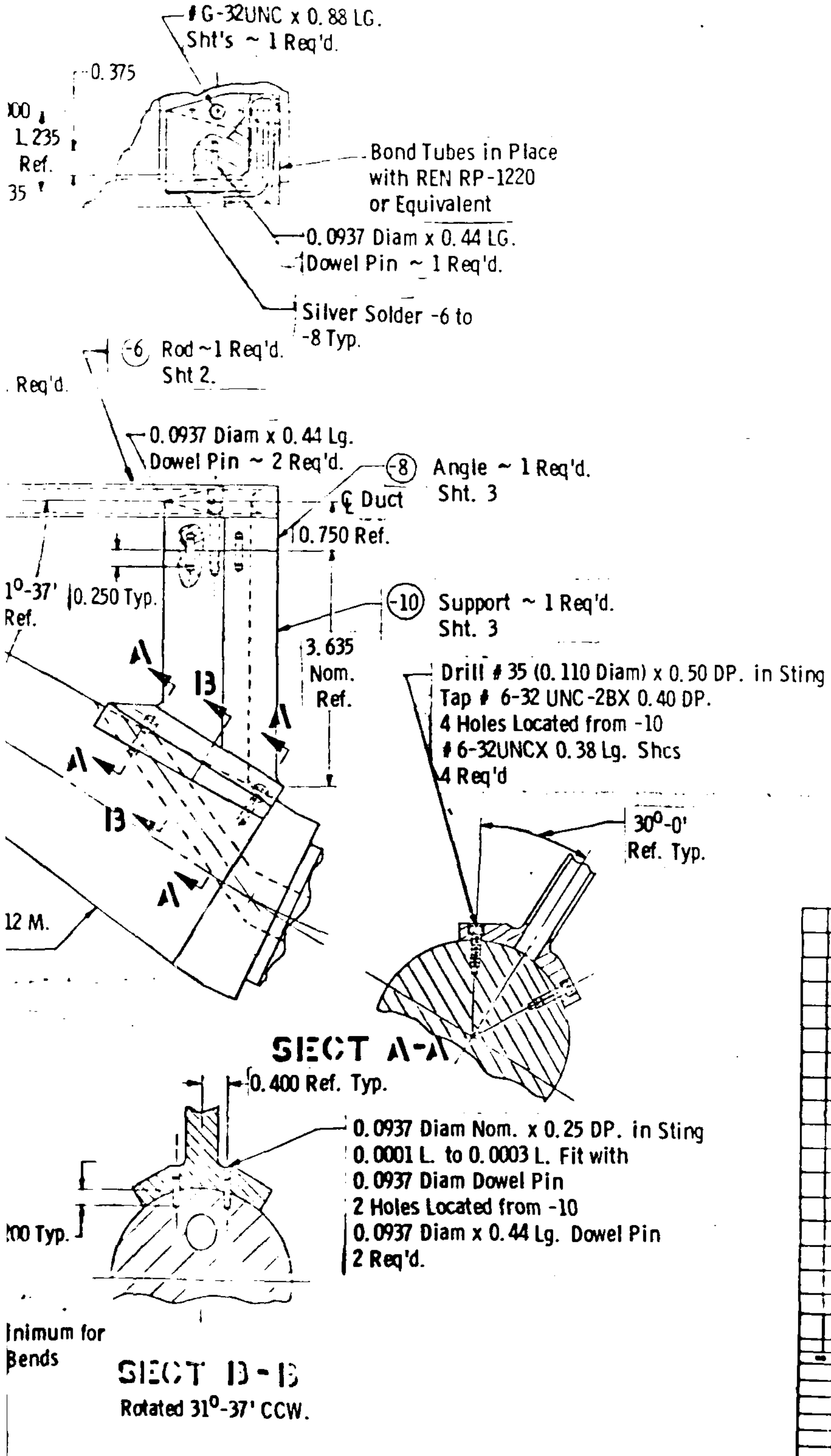
B.L. 0.000
1.235 Ref.
B.L. 1.235
0.0937 Diam
Dowel Pin
Silver Solder
-8 Typ.
5% F-4 Model
Ref. Douglas Dwg.
32-031326
R.H. Subsonic Pressure Choke
1 Req'd Ref. Dwg. P0008807
0.030
0.060
Typ
4 Star ~1 Req'd.
Sht. 2
6 Rod ~1 Req'd.
Sht 2.
5°-53' Ref.
W.L. 0.250
0.0937 Diam x 0.44 Lg.
Dowel Pin ~ 2 Req'd.
0.750 Ref.
31°-37' Ref.
0.250 Typ.
3.635
Nom.
Ref.
1.75 Diam Dummy Balance
Ref. Dwg. # 3203922
F.S.
17.750
F.S.
25.75
BSA-1.312F-13.66-19.6°-2.312 M.
Ref. Dwg. # 3203927
-2 Rake Ass'y
1 Req'd.
Full Size
SECT A
0.050" OD, 0.0075" Wall x 1.0" Lg.
SST. Tubing ~ 13 Req'd.
Cut to Length at Ass'y.
Silver Solder - 4
To -6 Typ. 12 Places
Silver Solder Typ. 13 Places
0.200 Typ.
0.400 Ref. Typ.
2 Holes
2 Req
0.188 R. Minimum for
All Tubing Bends
1.50 Typ.
Silver Solder
Typ. 13 Places
Must Be Air Tight
0.064" OD, 0.0095" Wall
x 25' Lg. SST Tubing
13 Req'd.
0°
60°
90°
120°
180°
240°
270°
300°
SECT C-C
Twice Size
SECT B-B
Rotated 31°-37' CCW.



Qty -2	Part No.	Part Name	Material Description	Stock Size
4		# 6-32 UNC x .38	LG SHCS	
1		# 6-32 UNC x .88	LG SHCS	
5		.0937 DIA x .44	LG. DOWEL PIN	
13		.050" OD, .0075"	WALL x 1.0" LG SST	TUB NG
13		.064" OD, .0095"	WALL x 25" LG. SST	TUB NG
1	-10	SUPPORT		
1	-8	ANGLE		
1	-6	ROD		
1	-4	STRP		
1	-2	RAKE ASSY		

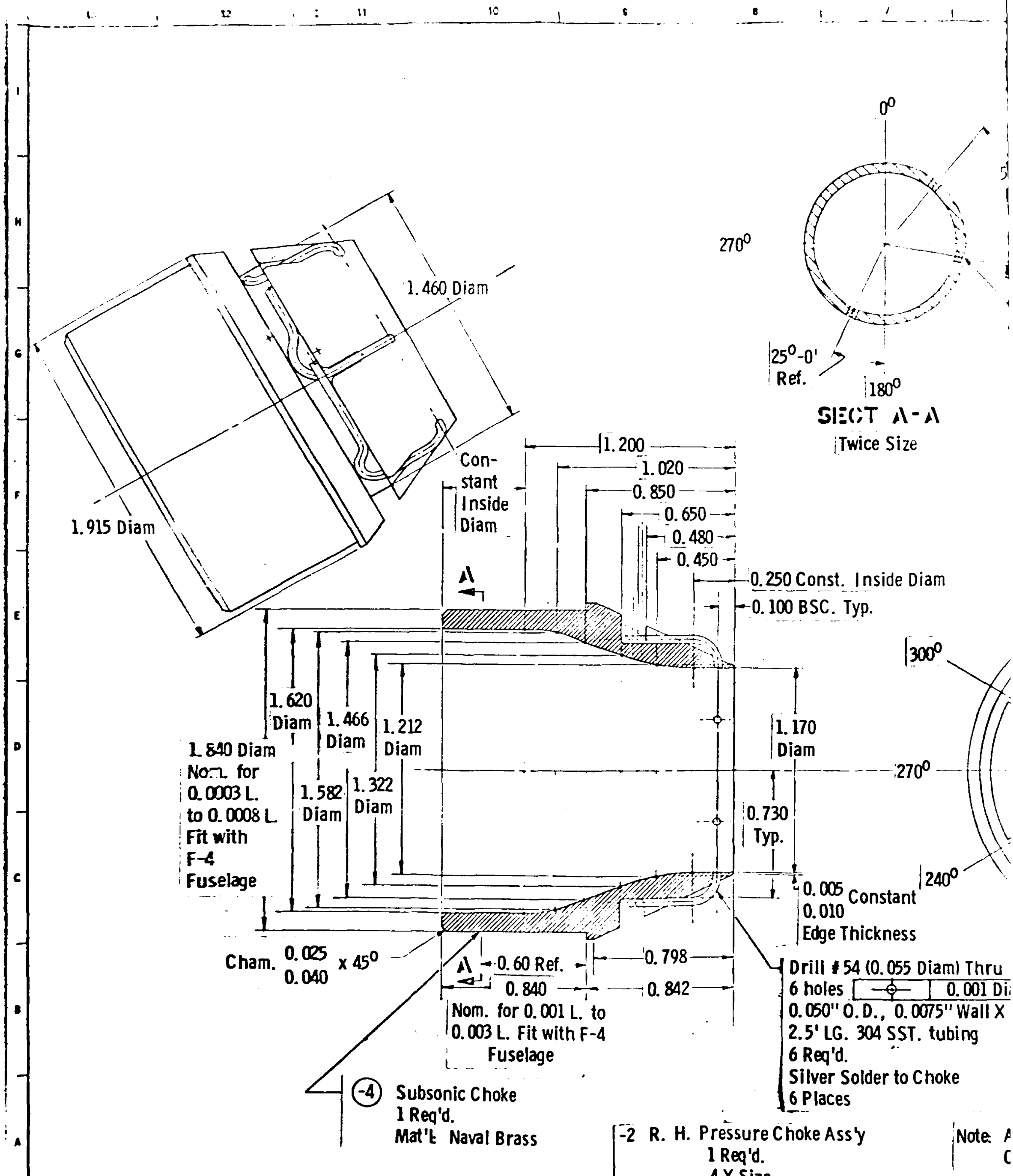
PC006798

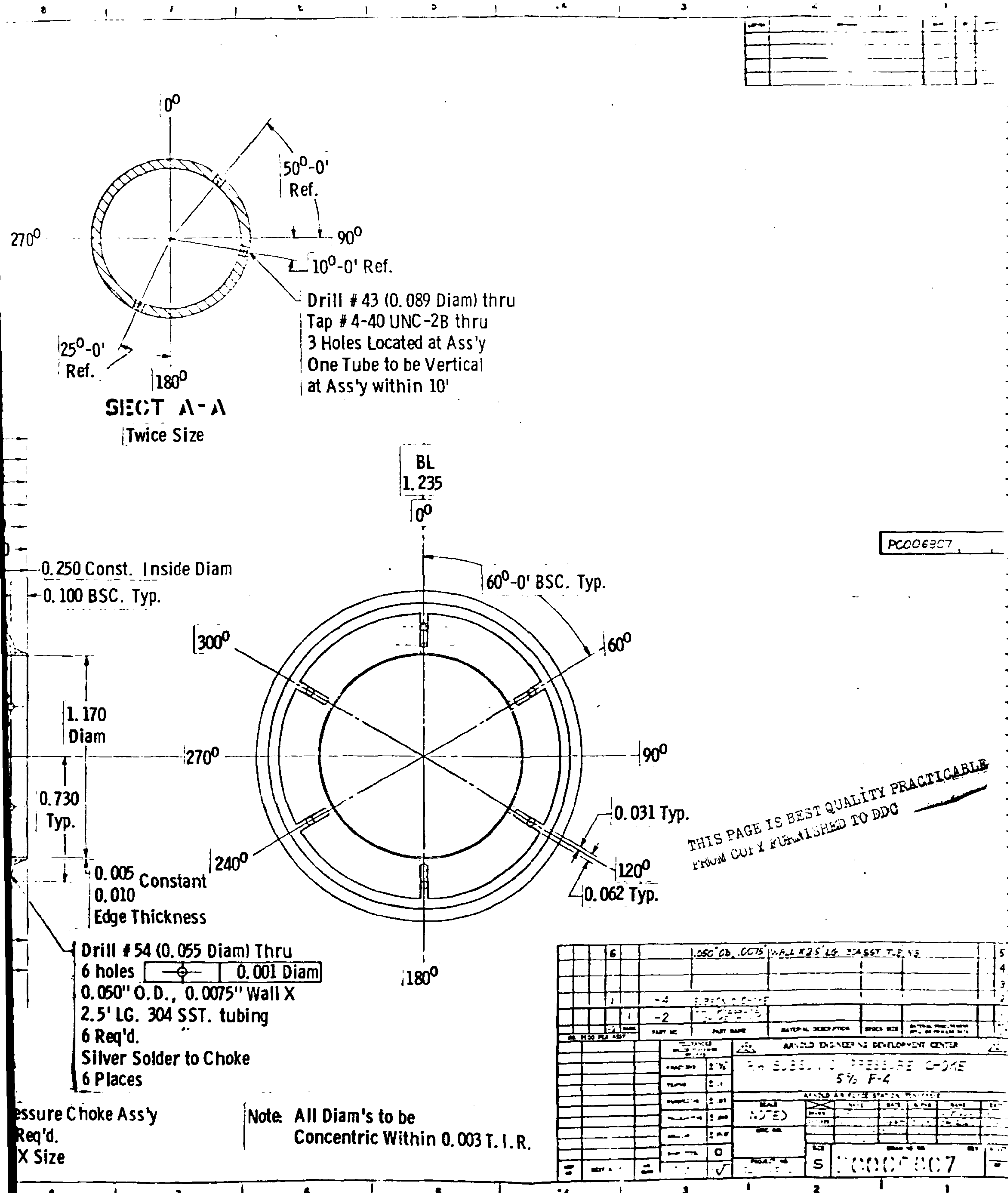
ARNOLD ENGINEERING DEVELOPMENT CENTER

PRESSURE RAKE
5% F-4

ARNOLD AIR FORCE STATION

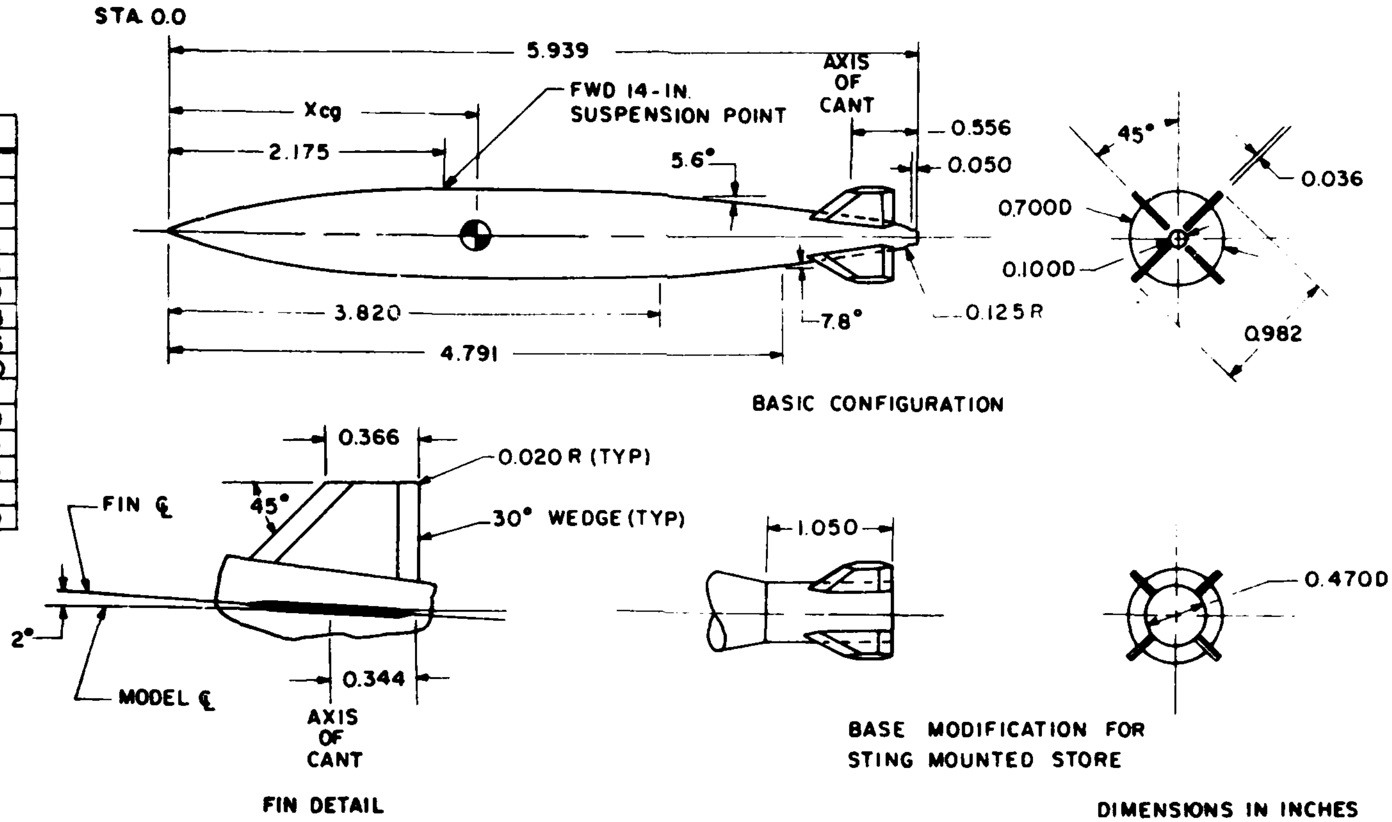
S PC006798


0°
270°
25°-0' Ref.
180°
SECT A-A
Twice Size
1.460 Diam
1.915 Diam
Con-stant Inside Diam
1.200
1.020
0.850
0.650
0.480
0.450
0.250 Const. Inside Diam
0.100 BSC. Typ.
A
300°
1.620 Diam
1.466 Diam
1.212 Diam
1.170 Diam
1.840 Diam Nom. for 0.0003 L. to 0.0008 L. Fit with F-4 Fuselage
1.582 Diam
1.322 Diam
270°
0.730 Typ.
0.005
0.010
Constant Edge Thickness
240°
Cham. 0.025 0.040 x 45°
0.60 Ref.
0.798
0.840
0.842
Nom. for 0.001 L. to 0.003 L. Fit with F-4 Fuselage
Drill # 54 (0.055 Diam) Thru
6 holes
0.001 Di
0.050" O.D., 0.0075" Wall X
2.5' LG. 304 SST. tubing
6 Req'd.
Silver Solder to Choke
6 Places
-4 Subsonic Choke
1 Req'd.
Mat'l. Naval Brass
-2 R. H. Pressure Choke Ass'y
1 Req'd.
4 X Size
Note



0°
50°-0' Ref.
270°
90°
10°-0' Ref.
Drill # 43 (0.089 Diam) thru
Tap # 4-40 UNC-2B thru
3 Holes Located at Ass'y
One Tube to be Vertical
at Ass'y within 10'
25°-0' Ref.
180°
SECT A-A
Twice Size
BL 1.235
0°
0.250 Const. Inside Diam
0.100 BSC. Typ.
60°-0' BSC. Typ.
300°
60°
1.170 Diam
270°
90°
0.730 Typ.
0.031 Typ.
240°
120°
0.005 0.010 Constant Edge Thickness
0.062 Typ.
Drill # 54 (0.055 Diam) Thru
6 holes 0.001 Diam
0.050" O.D., 0.0075" Wall X
2.5' LG. 304 SST. tubing
6 Req'd.
Silver Solder to Choke
6 Places
180°
essure Choke Ass'y
Req'd.
X Size
Note: All Diam's to be Concentric Within 0.003 T.I.R.
PC006807
ARNOLD ENGINEERING DEVELOPMENT CENTER
5% F-4
NOTED
S

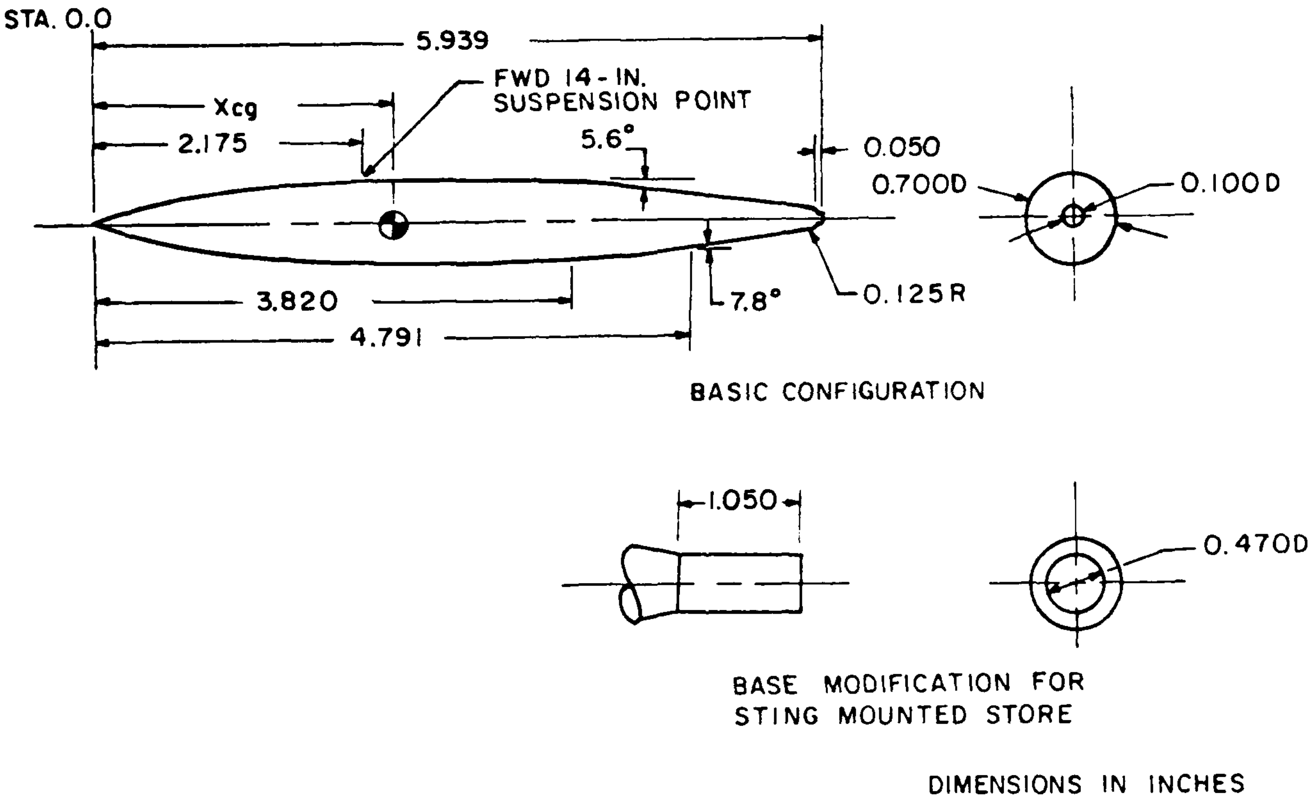
STA	DIAM
0	0
0.267	0.231
0.517	0.378
0.783	0.482
1.050	0.554
1.317	0.609
1.583	0.653
1.850	0.686
2.117	0.700
CONST	DIAM
2.983	0.700
3.250	0.693
3.383	0.686
3.650	0.661
3.820	0.639



a. Finned

Figure 7. Mk-83 Bomb Model

STA	DIAM
0	0
0.267	0.231
0.517	0.378
0.783	0.482
1.050	0.554
1.317	0.609
1.583	0.653
1.850	0.686
2.117	0.700
CONST	DIAM
2.983	0.700
3.250	0.693
3.383	0.686
3.650	0.661
3.820	0.639



b. Unfinned

Figure 7. Concluded

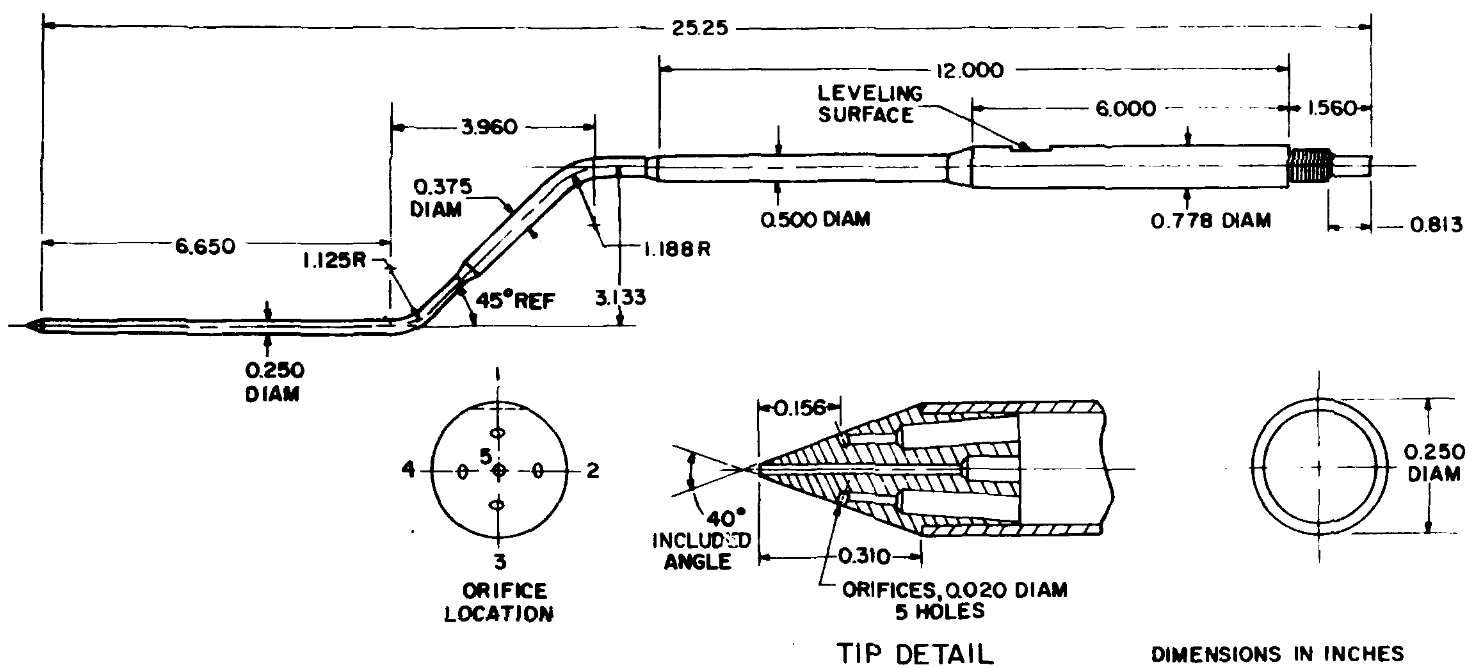
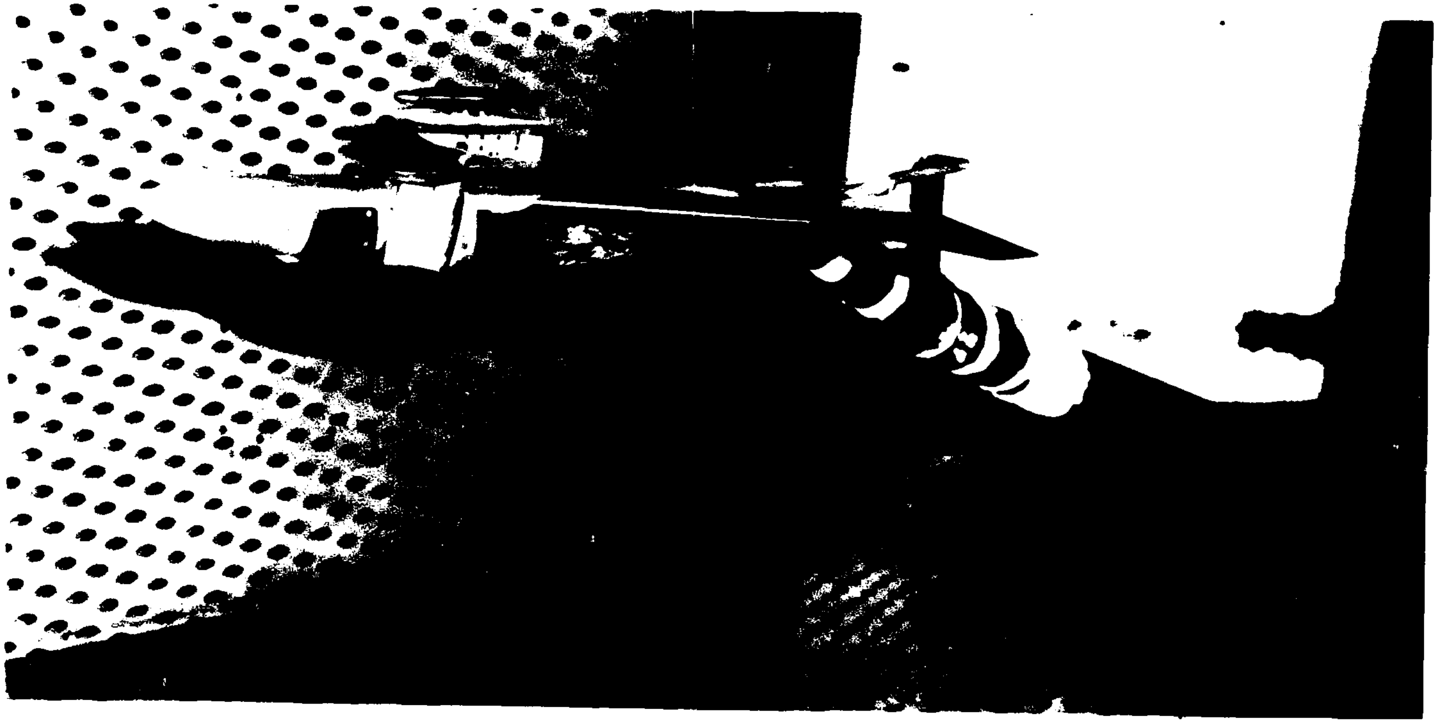


Figure 8. Details of Flow-Field Probe



a. Captive Loads Phase

Figure 9. Typical Tunnel Installation Photograph

b. Grid Phase

Figure 9. Concluded

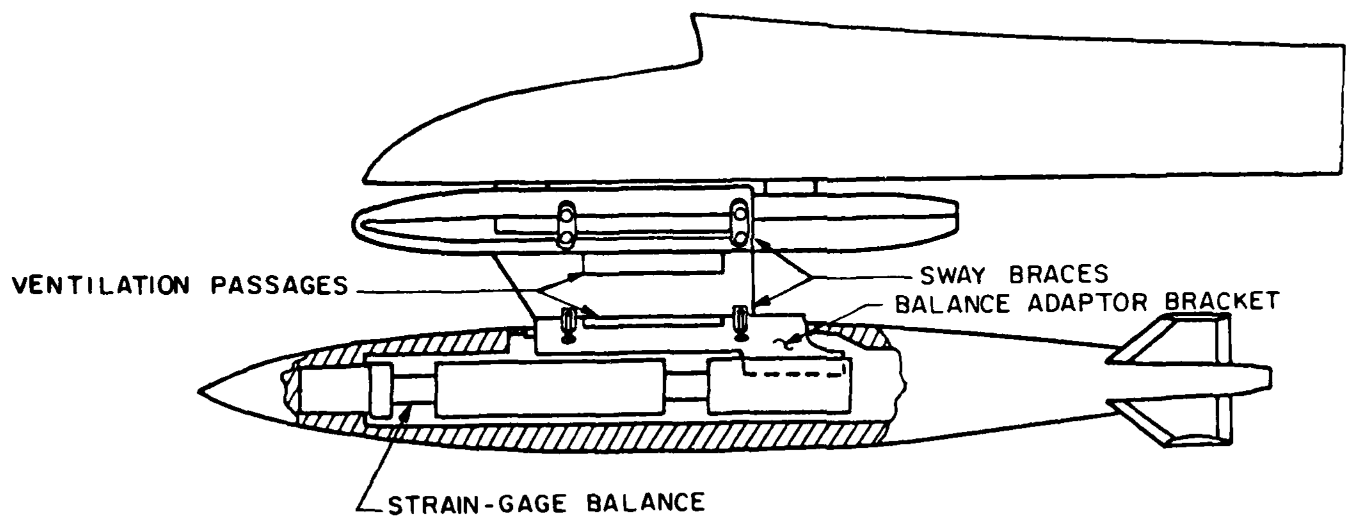
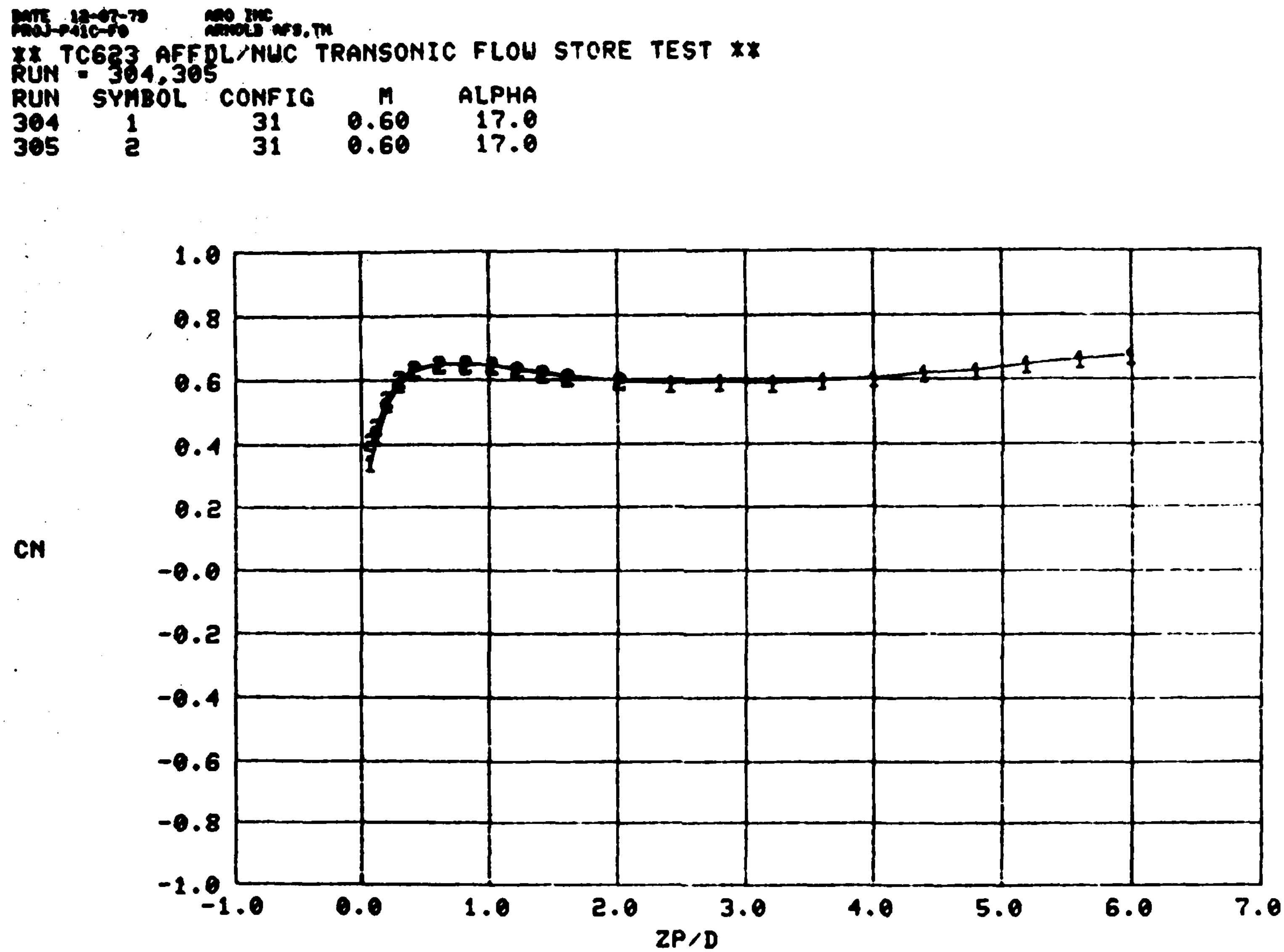


Figure 10. Captive Loads Store, Balance and TER Assembly

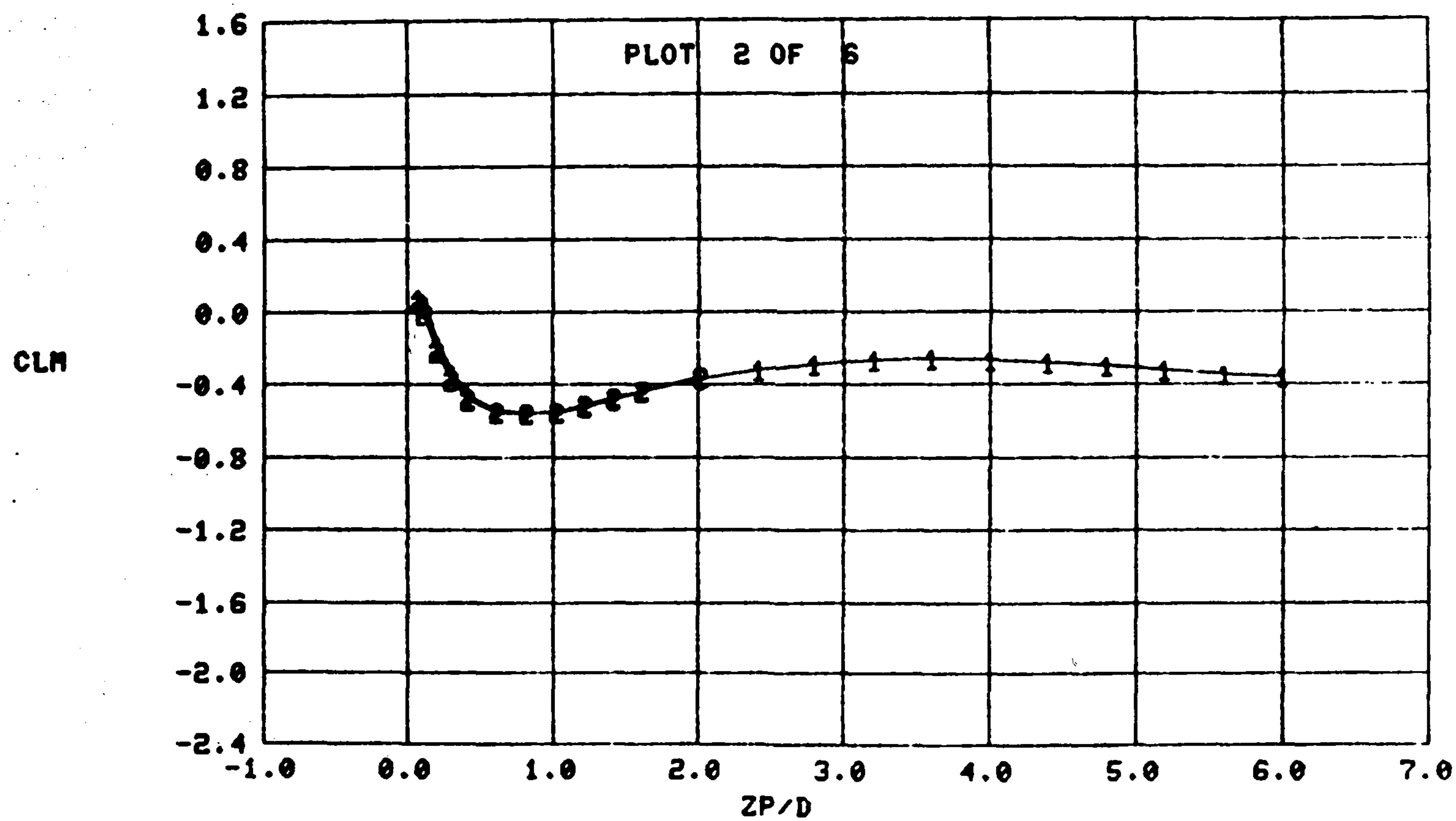


a. CN vs ZP/D

Figure 11. Example of Data Repeatability

DATE 12-07-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 304,305

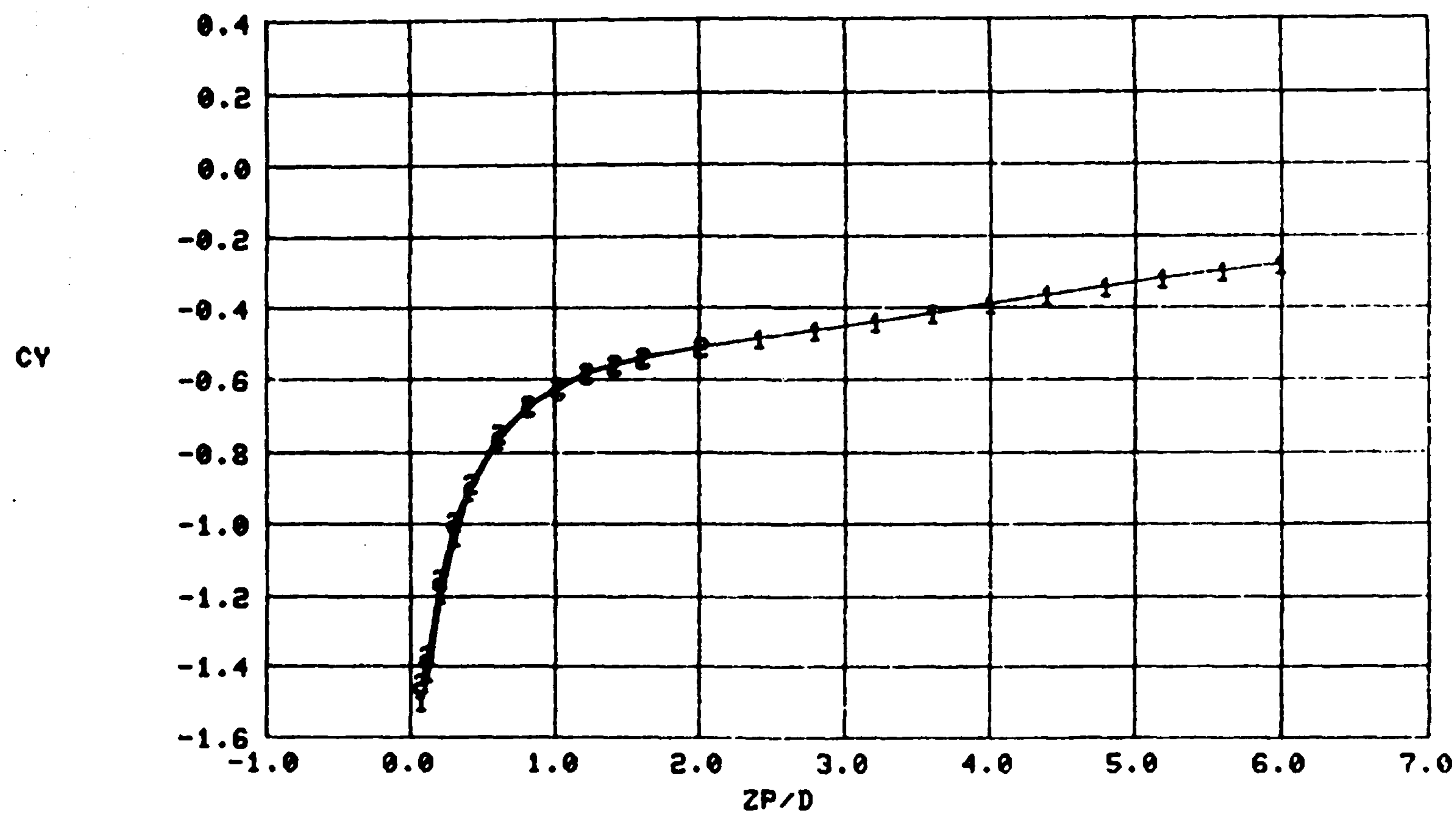
RUN	SYMBOL	CONFIG	M	ALPHA
304	1	31	0.60	17.0
305	2	31	0.60	17.0



b. CLM vs ZP/D
Figure 11. Continued

DATE 12-07-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
XX TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST XX
RUN = 304,305

RUN	SYMBOL	CONFIG	M	ALPHA
304	1	31	0.60	17.0
305	2	31	0.60	17.0

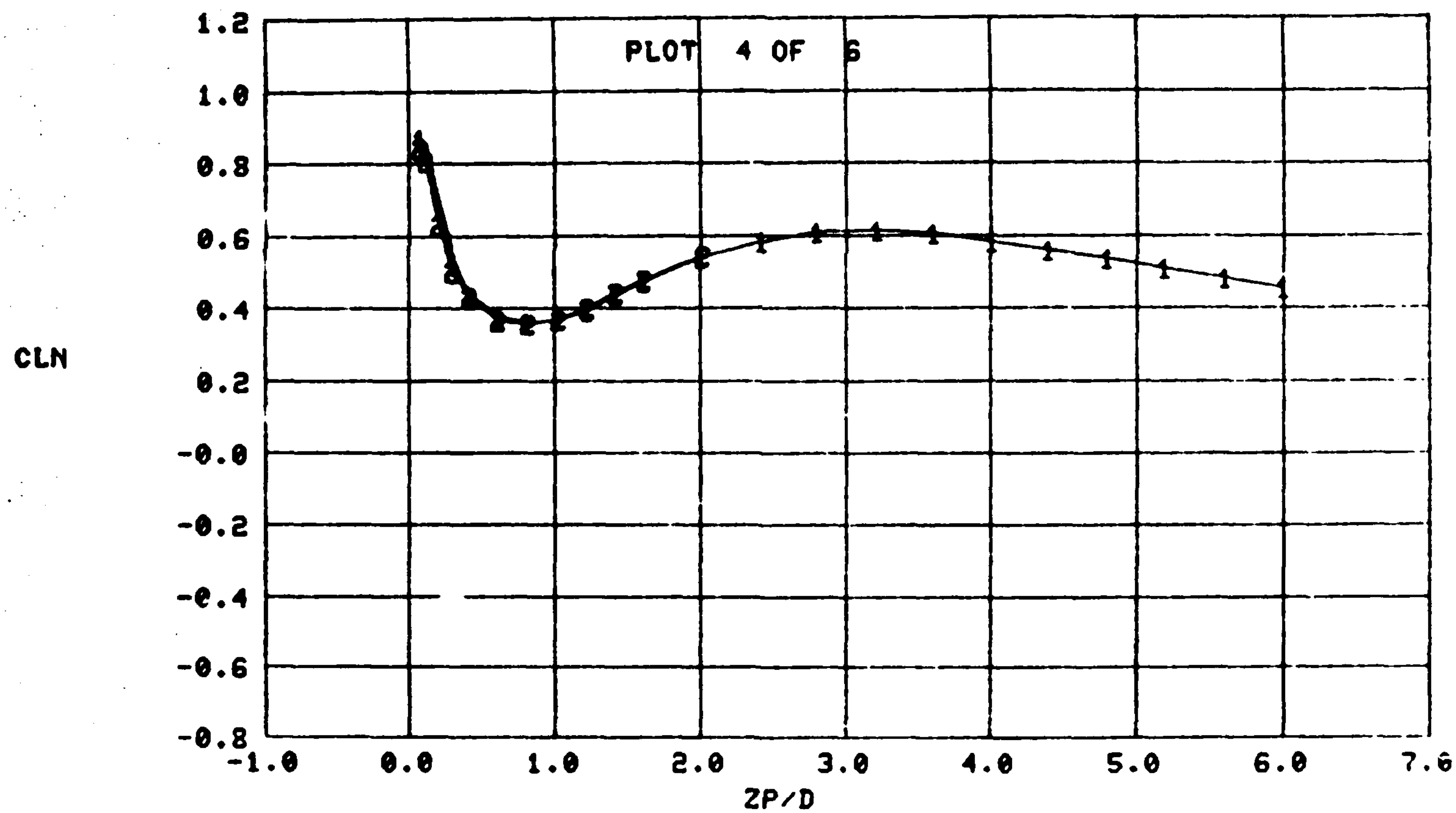


c. CY vs ZP/D

Figure 11. Continued

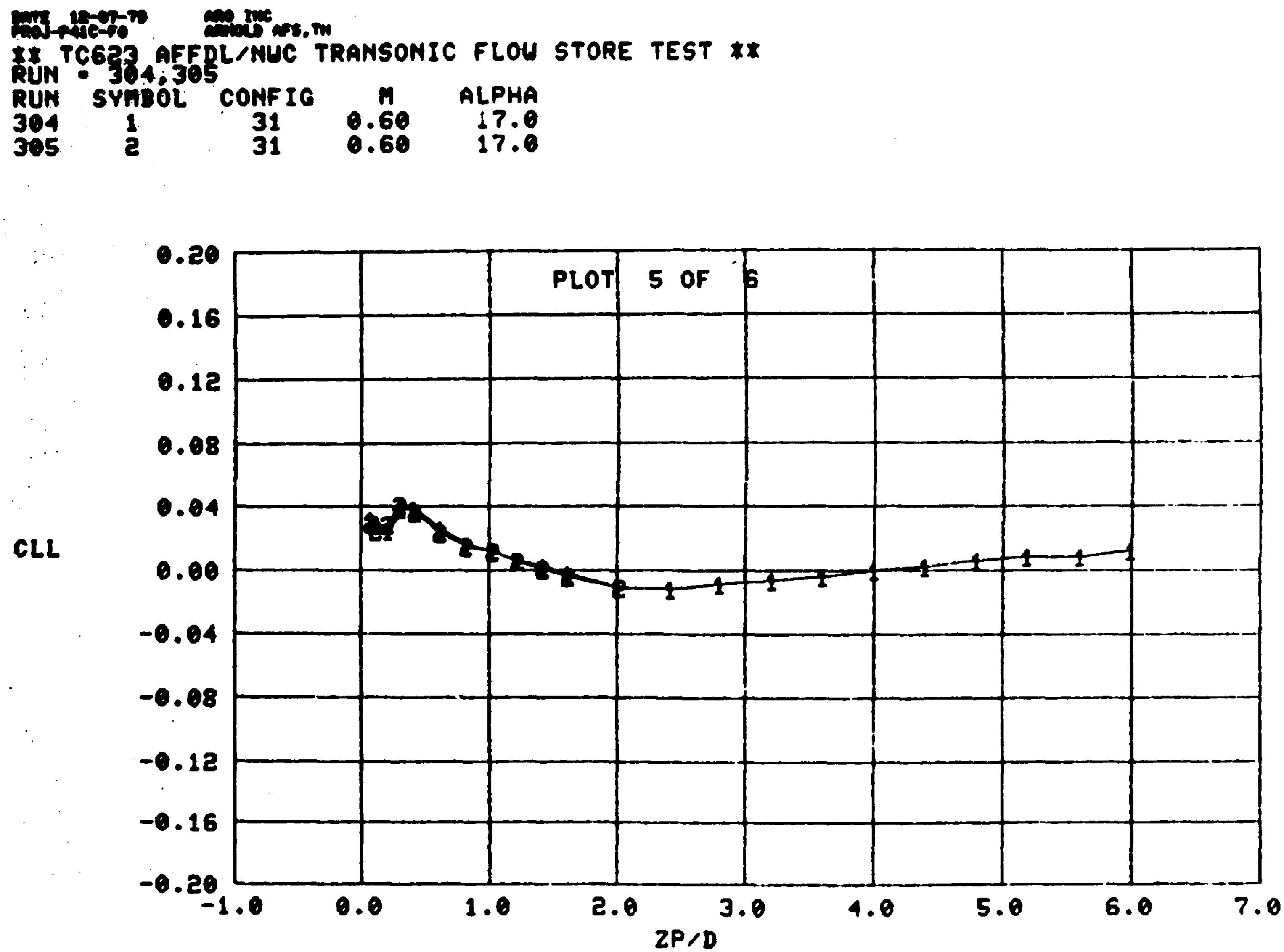
DATE 12-07-79   ARO INC
PROJ-P41C-F0   ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 304,305

RUN	SYMBOL	CONFIG	M	ALPHA
304	1	31	0.60	17.0
305	2	31	0.60	17.0



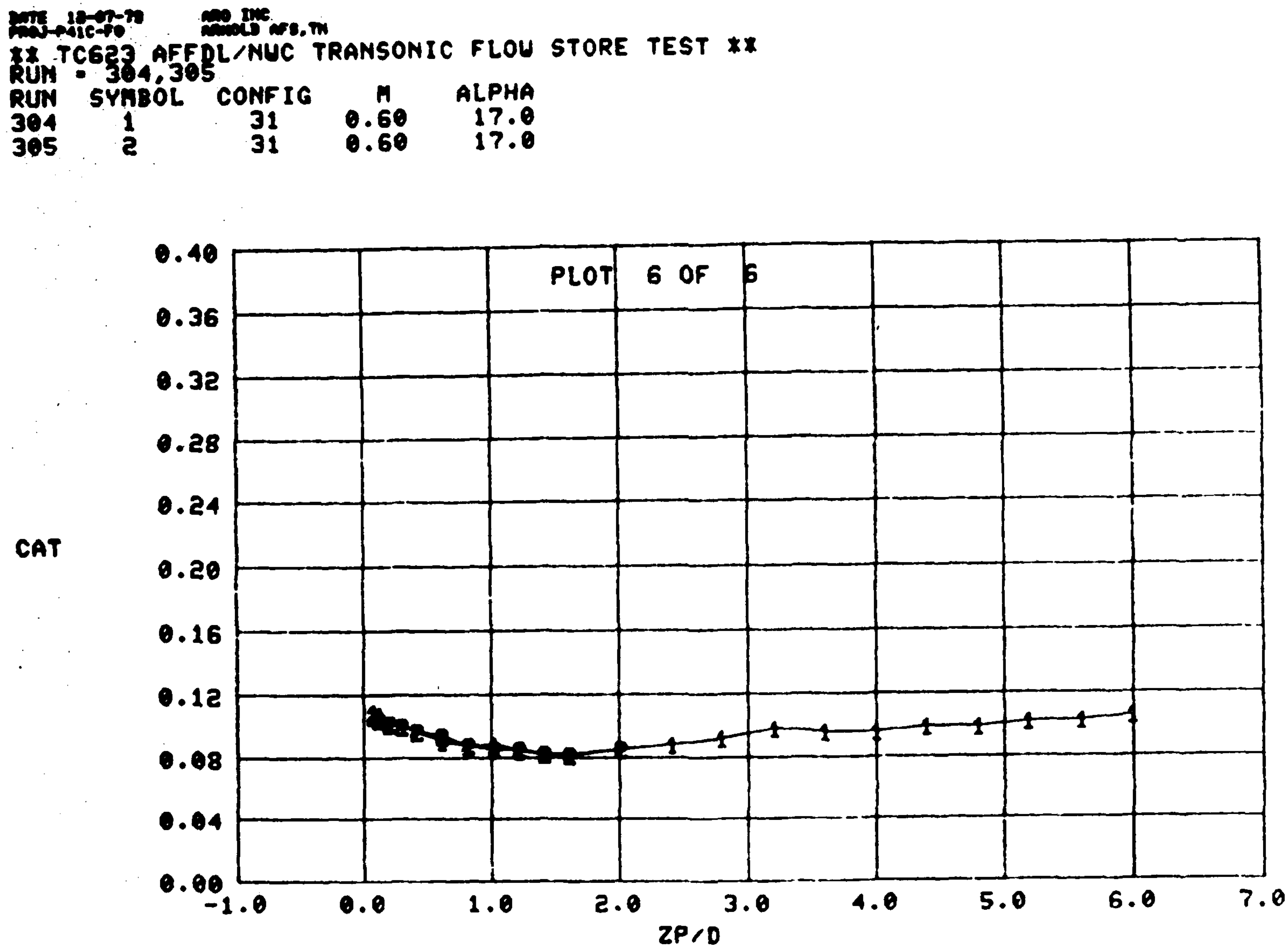
d. CLN vs ZP/D

Figure 11. Continued



e. CLL vs ZP/D

Figure 11. Continued

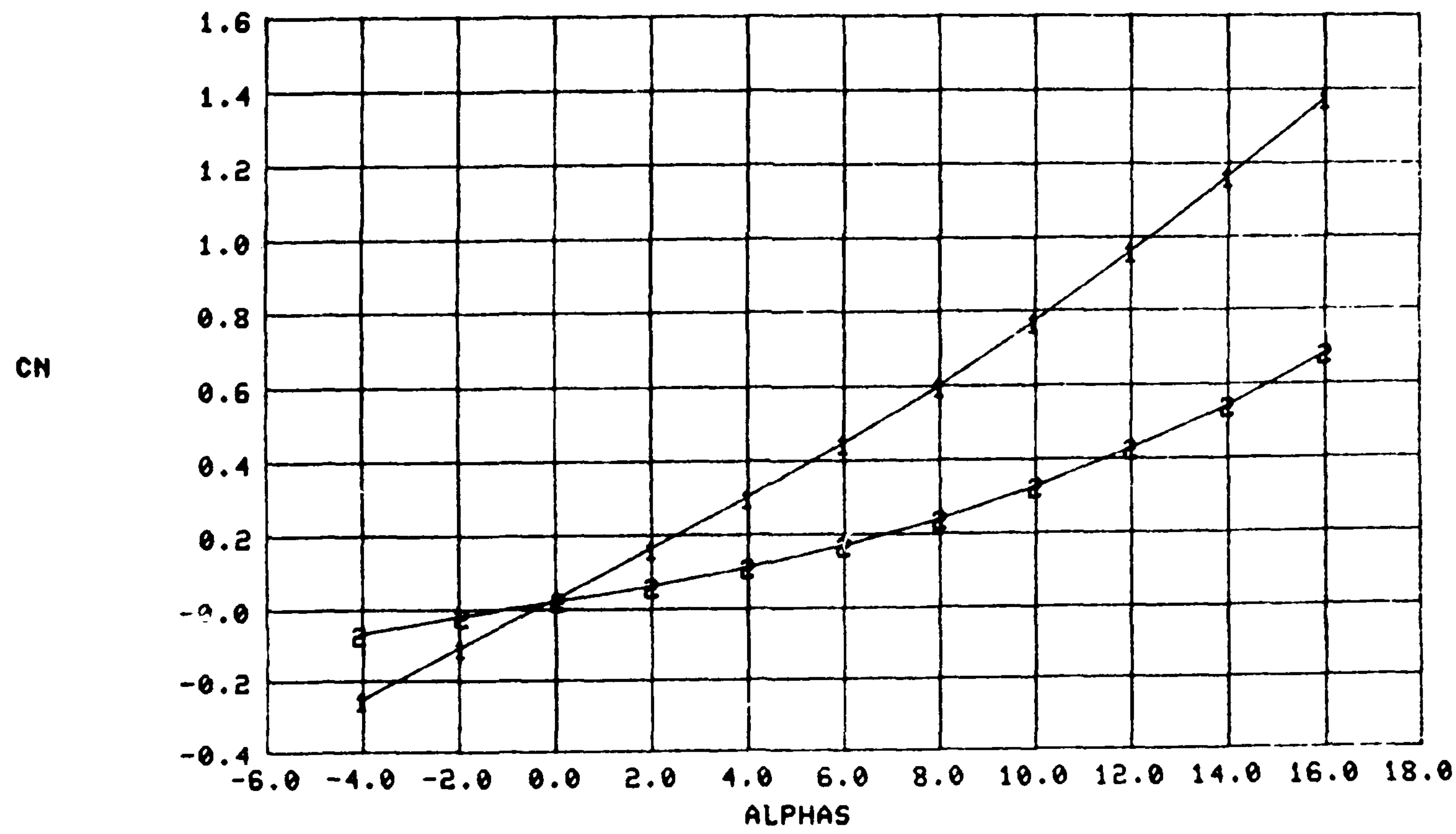


f. CAT vs ZP/D

Figure 11. Concluded

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 32,44

RUN	SYMBOL	CONFIG	M	DPHI
32	1	1	0.95	0.0
44	2	2	0.95	0.0

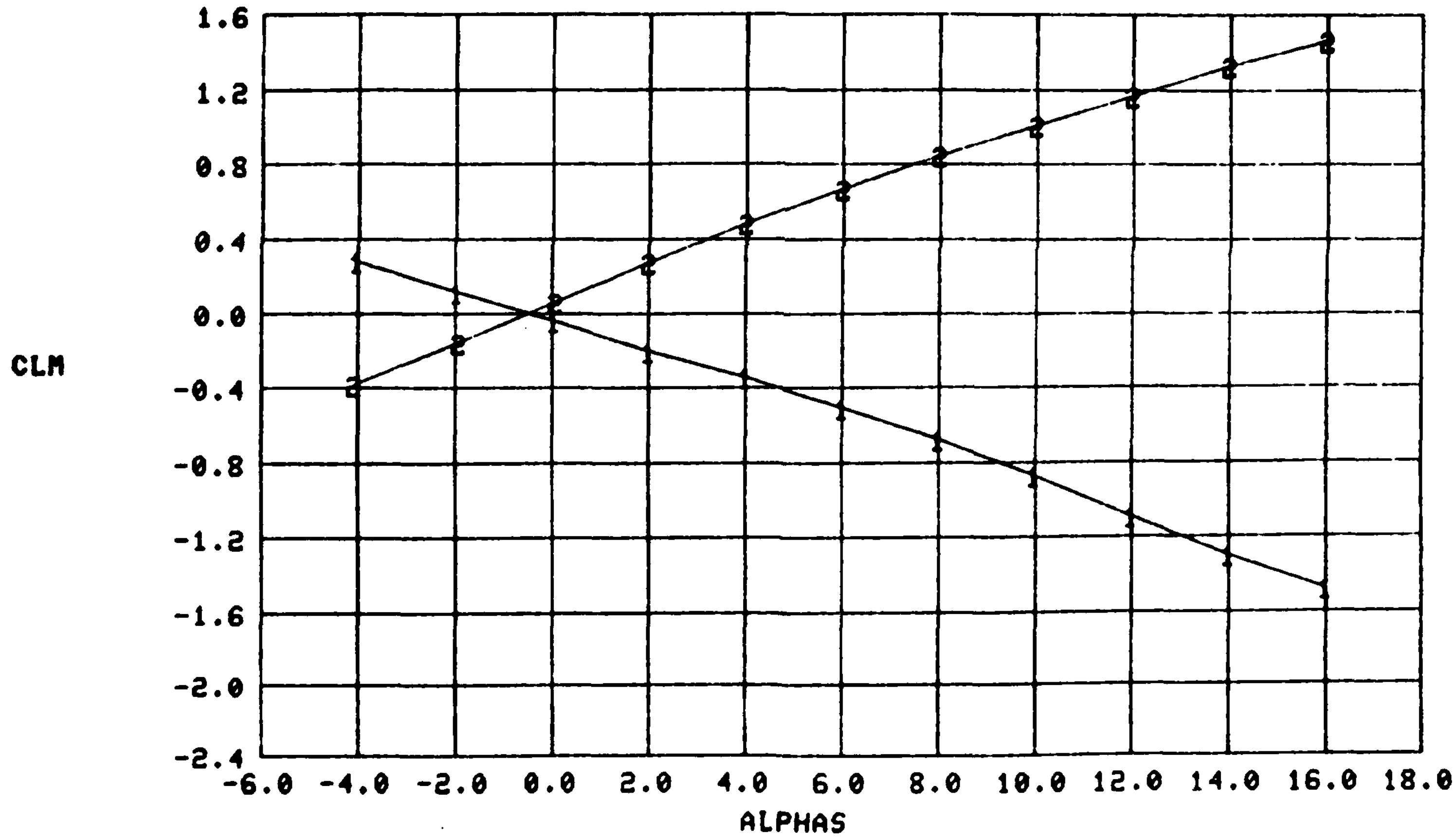


a. CN vs ALPHAS, Freestream

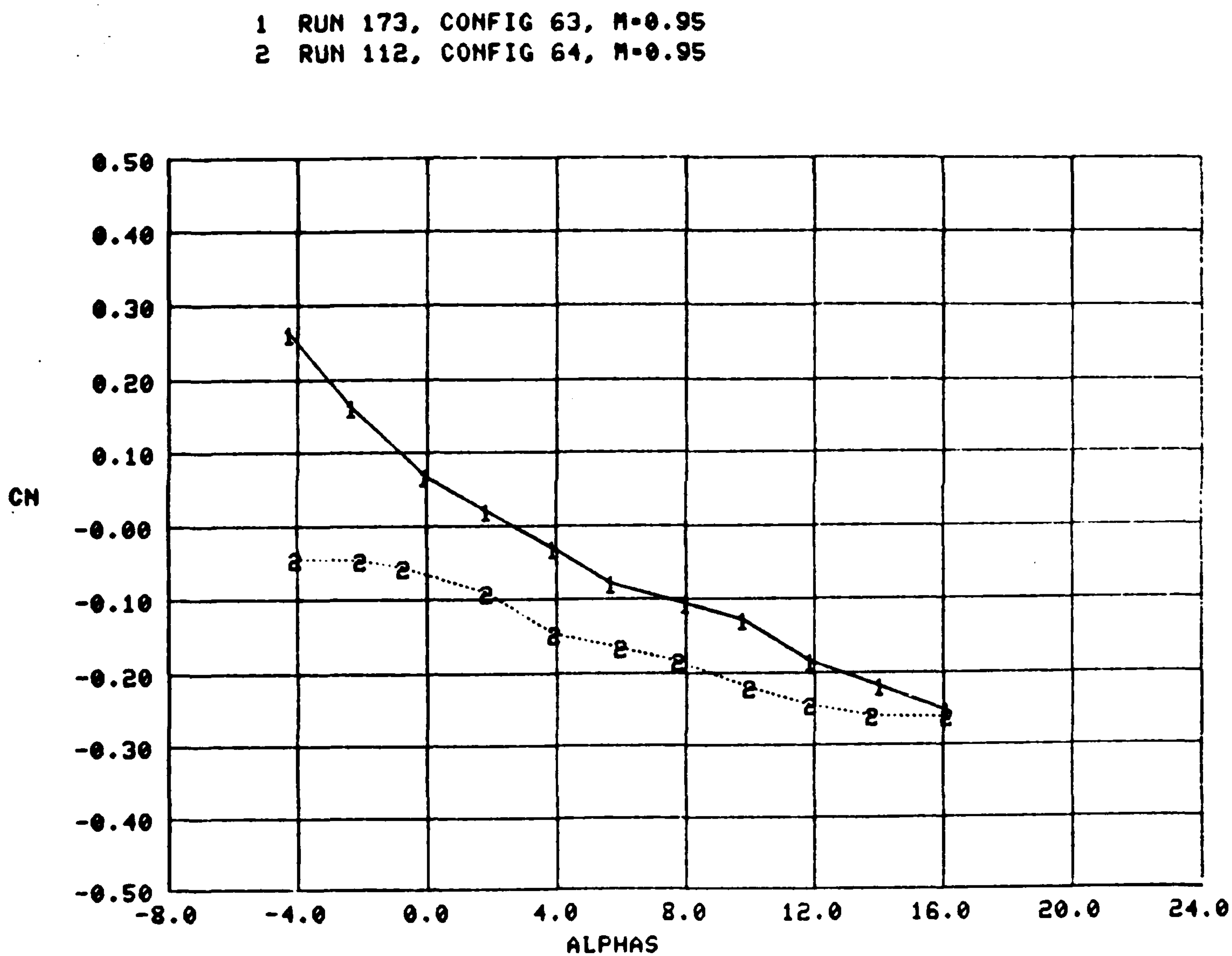
Figure 12. Typical On Line Plots

DATE 12-10-78 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **
RUN = 32,44

RUN	SYMBOL	CONFIG	M	DPHI
32	1	1	0.5	0.0
44	2	2	0.95	0.0

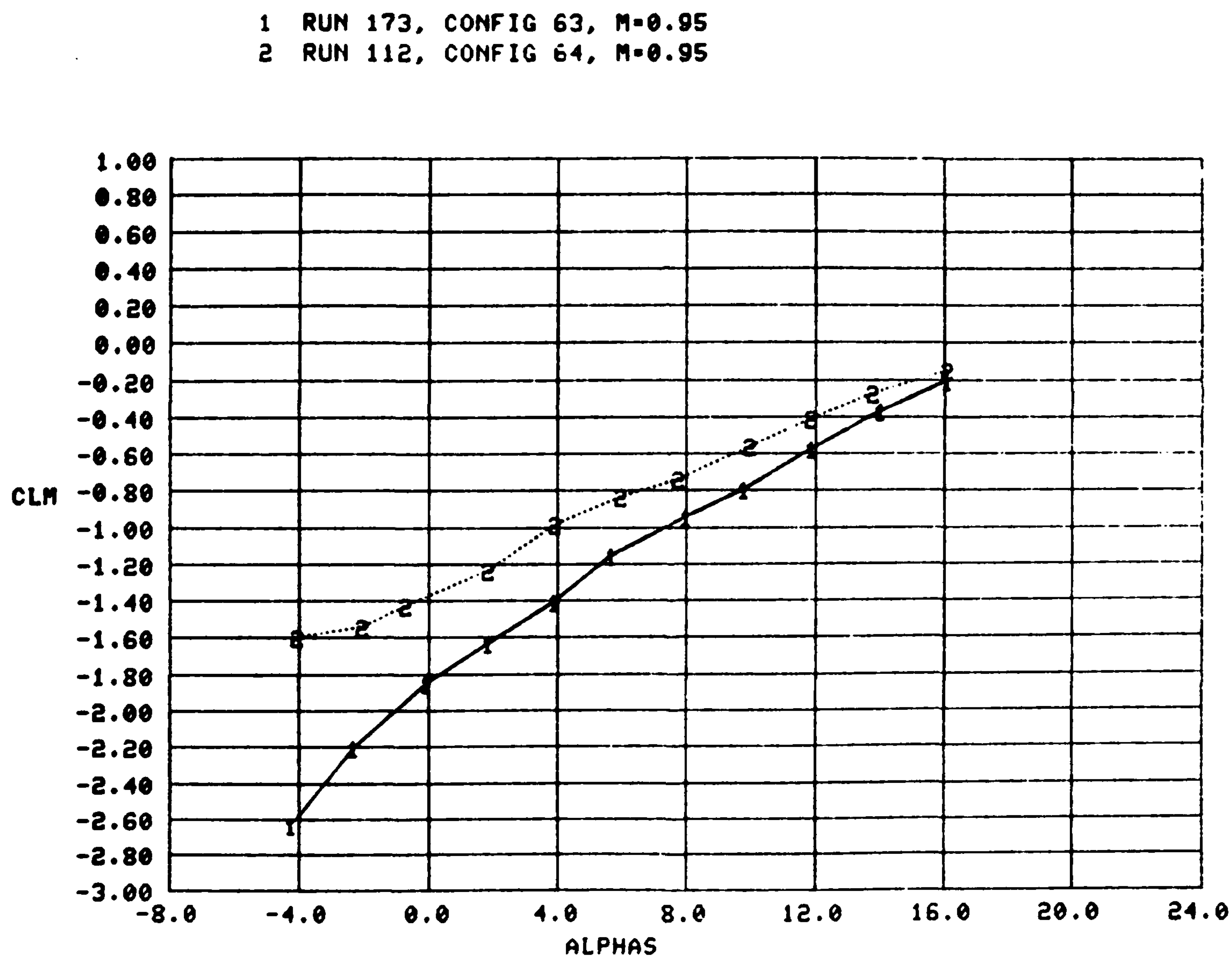


b. CLM vs ALPHAS, Freestream
Figure 12. Continued



c. CN vs ALPHAS, Captive Loads

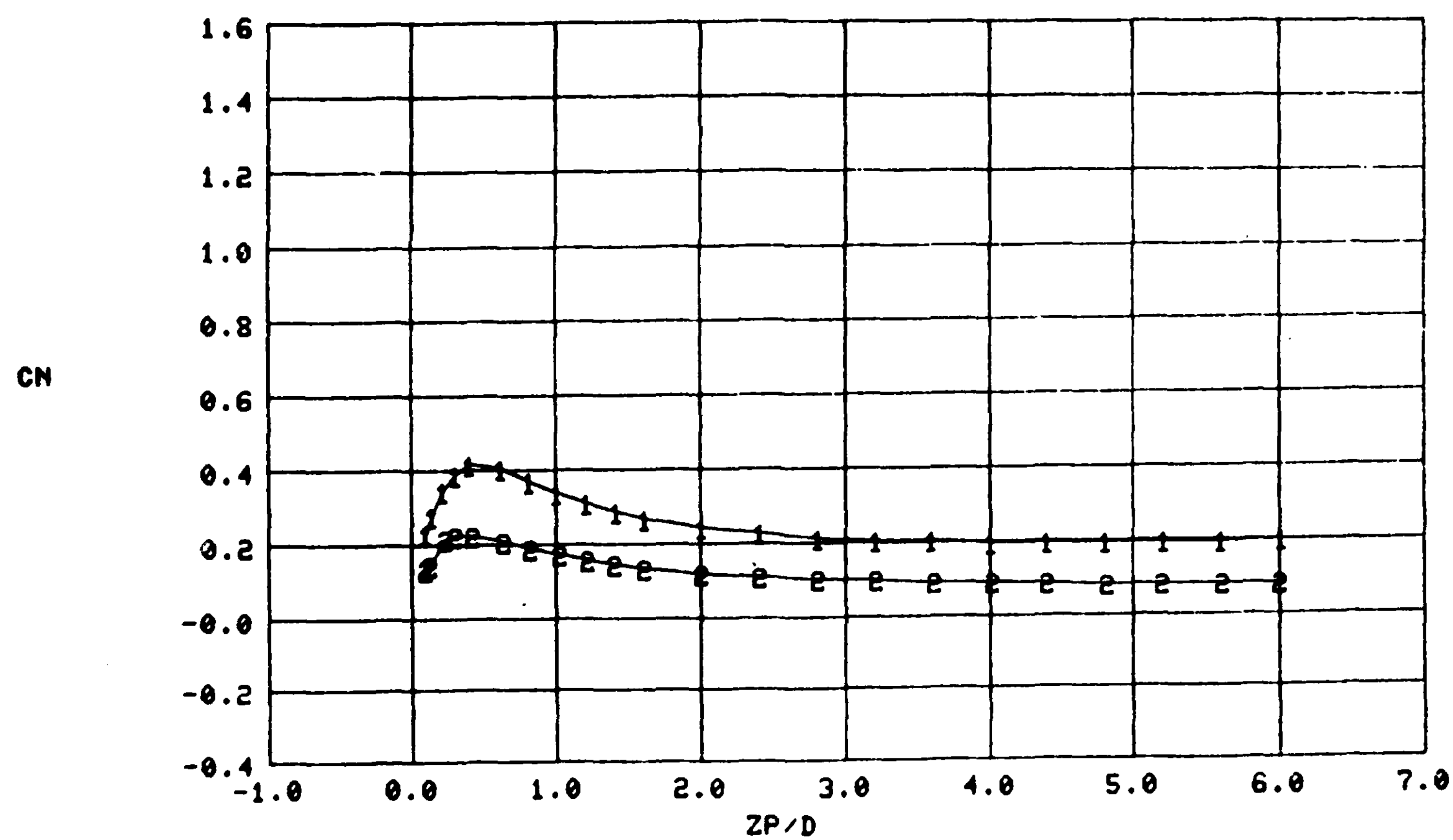
Figure 12. Continued



d. CLM vs ALPHAS, Captive Loads
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P61C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 275,244

RUN	SYMBOL	CONFIG	M	ALPHA
275	1	61	0.95	5.0
244	2	62	0.95	5.0

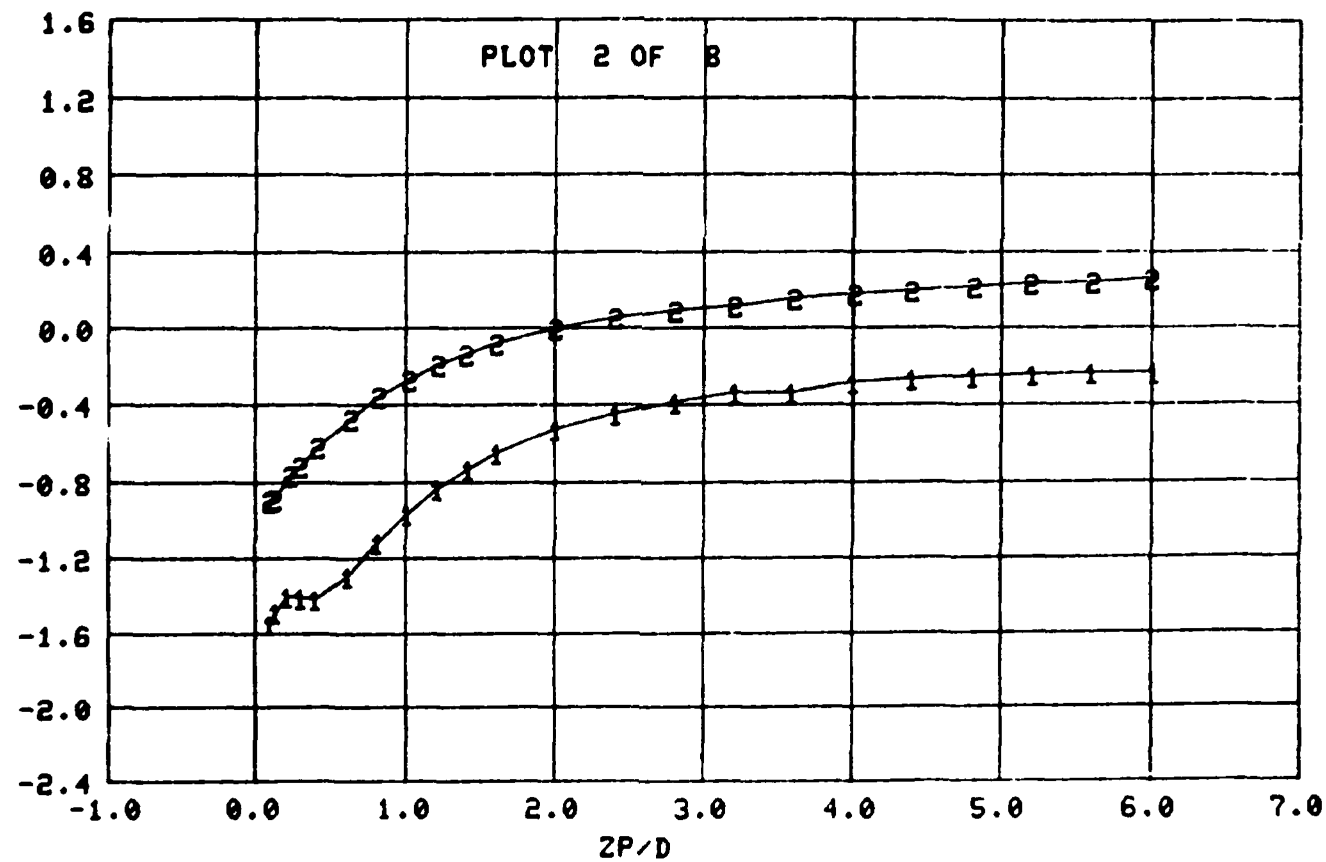


e. CN vs ZP/D, Grid Phase
Figure 12. Continued

DATE 12-10-78 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 275,244

RUN	SYMBOL	CONFIG	M	ALPHA
275	1	61	0.95	5.0
244	2	62	0.95	5.0



f. CLM vs ZP/D, Grid Phase

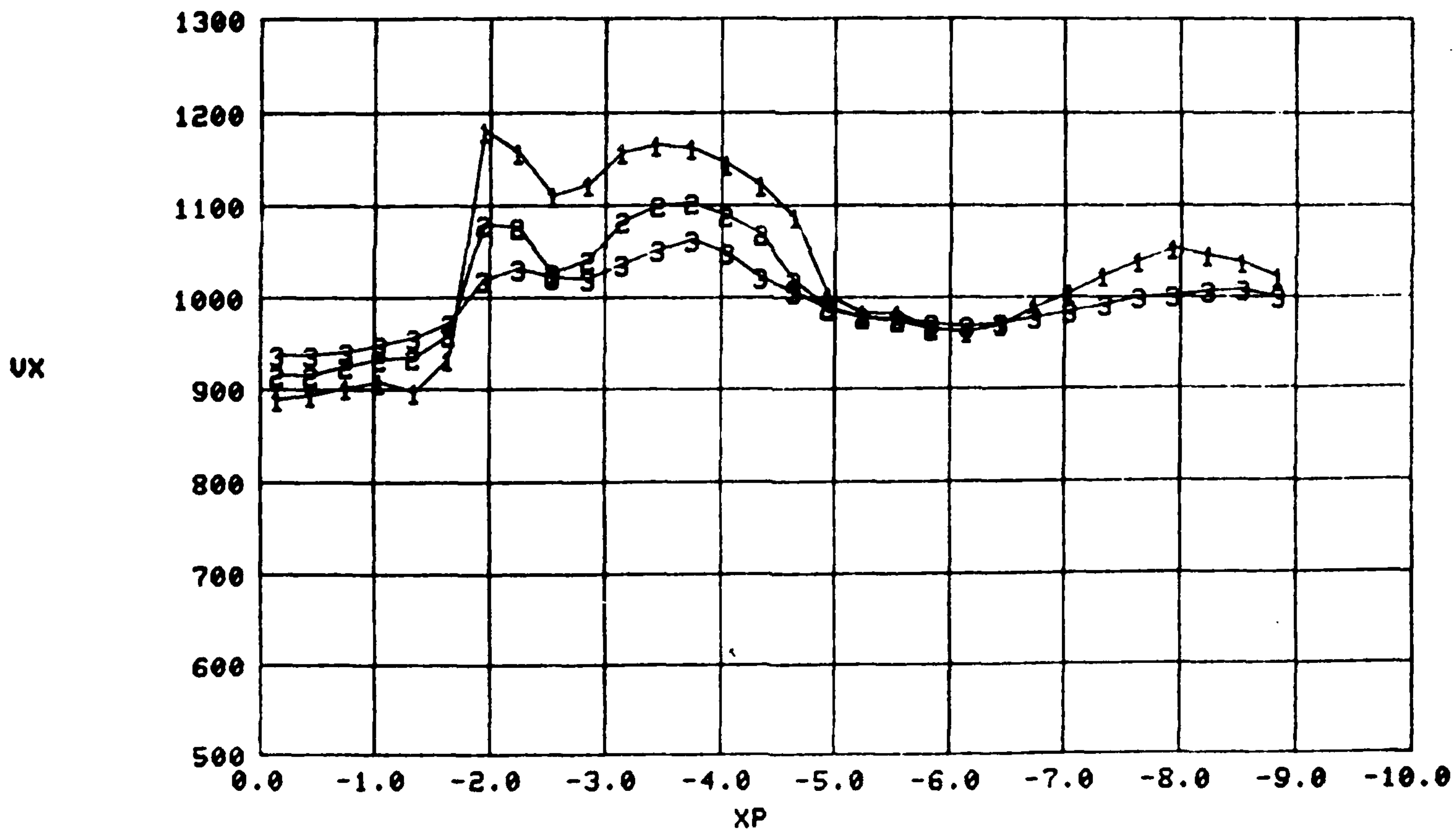
Figure 12. Continued

DATE 10-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

XX TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST XX

RUN = 713,714,715

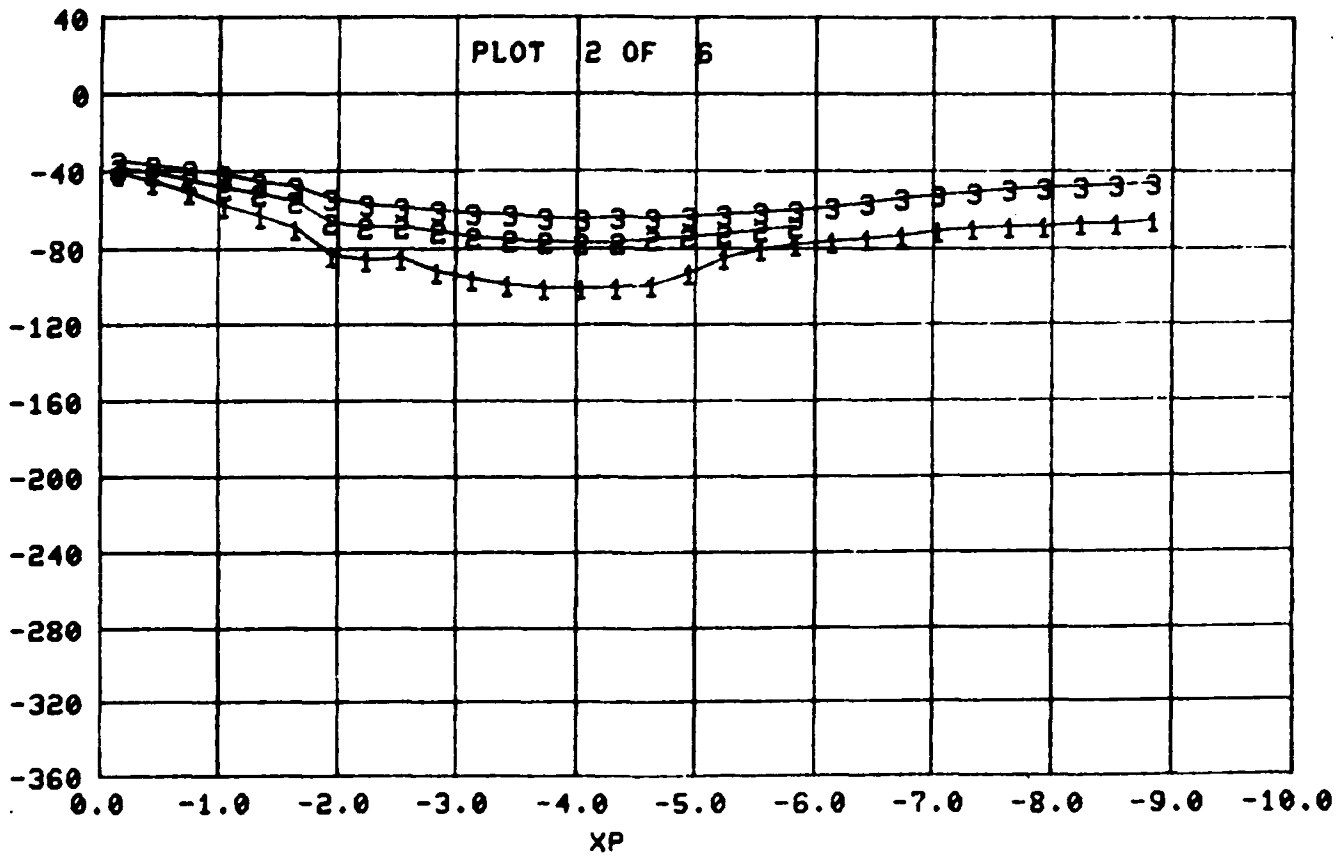
RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



g. VX vs XP, Flow-Field Phase
Figure 12. Continued.

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **
RUN = 713,714,715

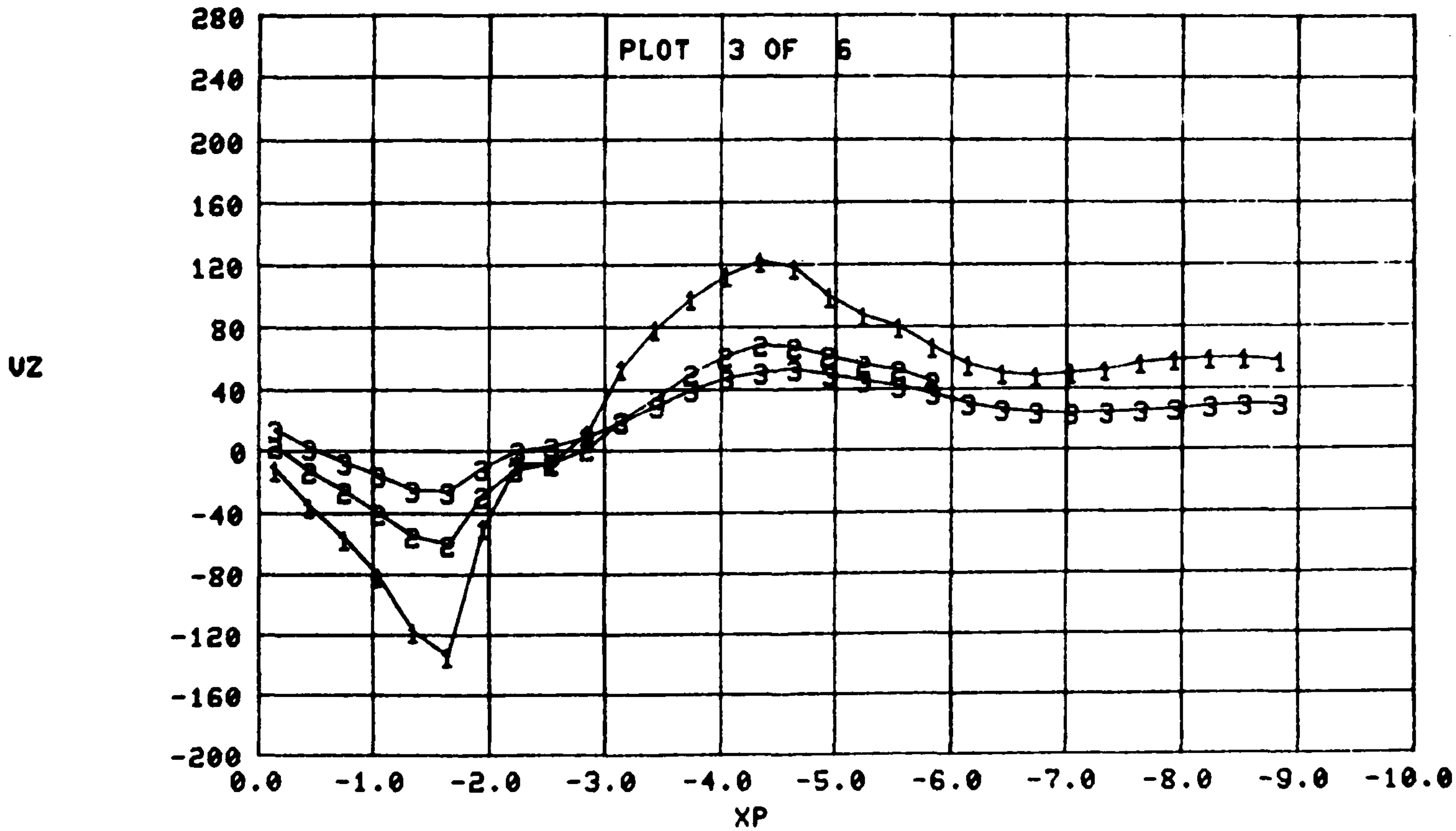
RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



h. VY vs XP, Flow-Field Phase
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN
** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **
RUN = 713,714,715

RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



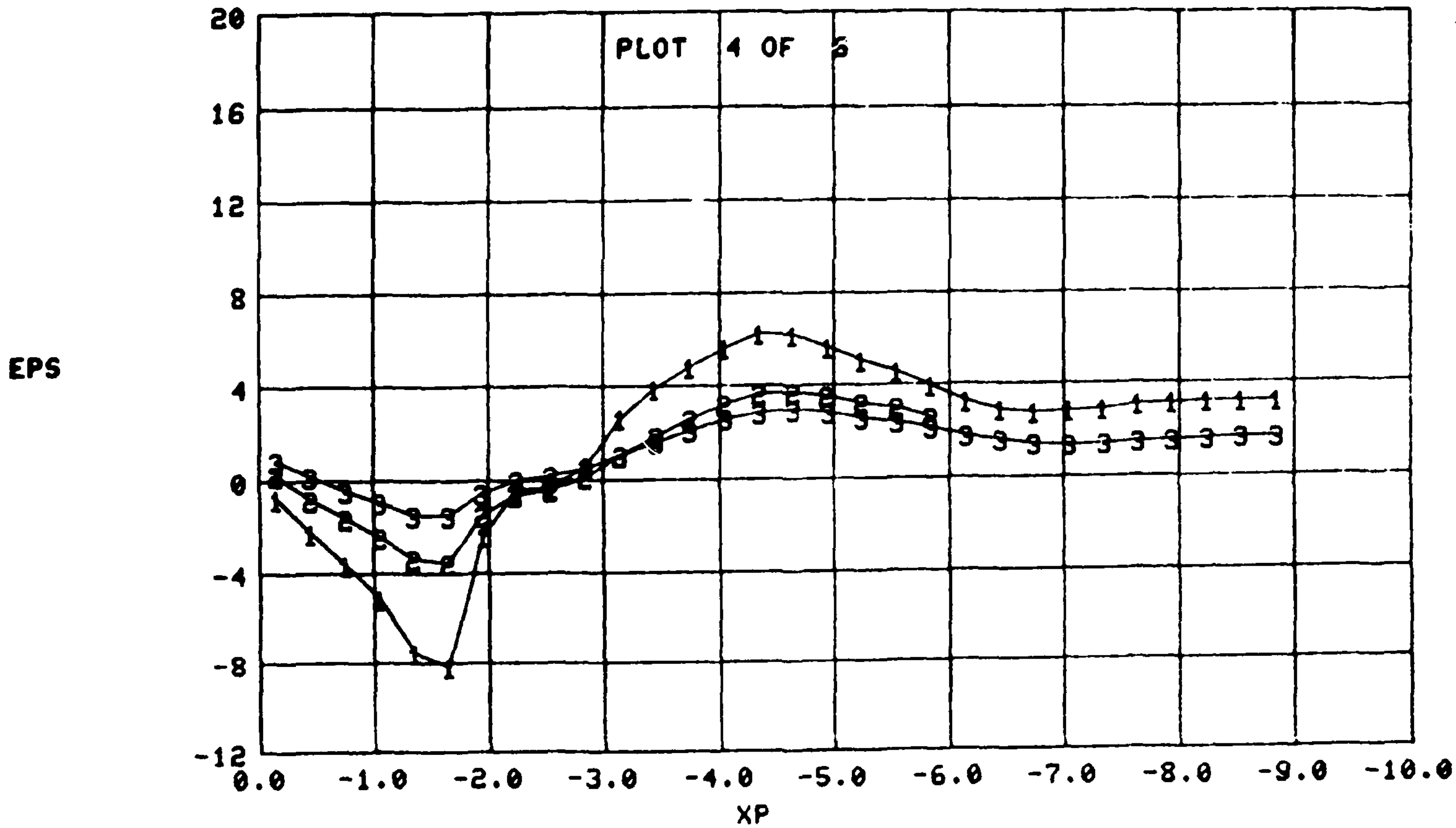
i. VZ vs XP, Flow-Field Phase
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



j. EPS vs XP, Flow-Field Phase

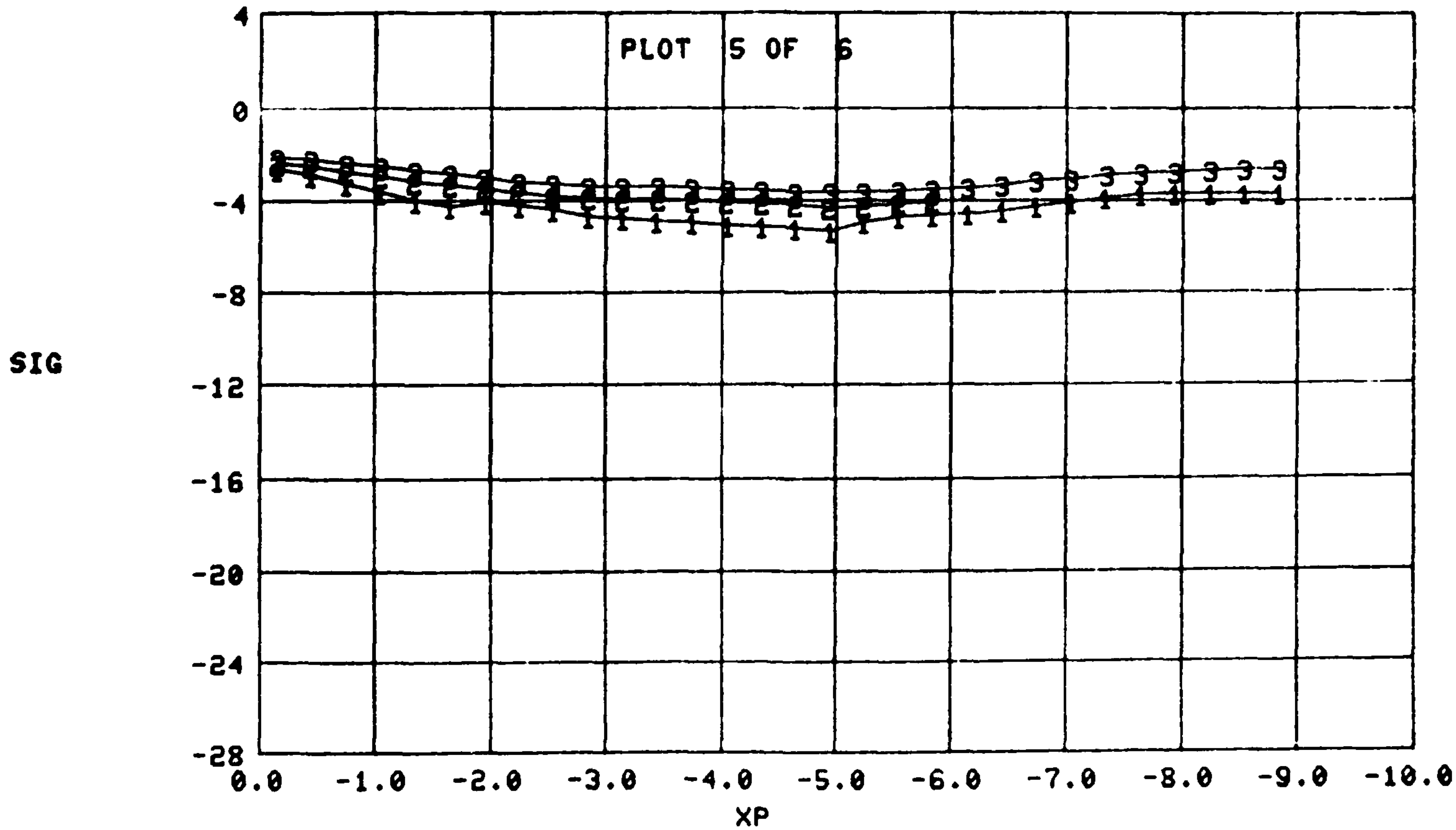
Figure 12. Continued

DATE 12-10-79 ARO INC
PROJ-P41C-F8 ARNOLD AFS,TN

** TC623 AFFDL/NUC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



k. SIG vs XP, Flow-Field Phase

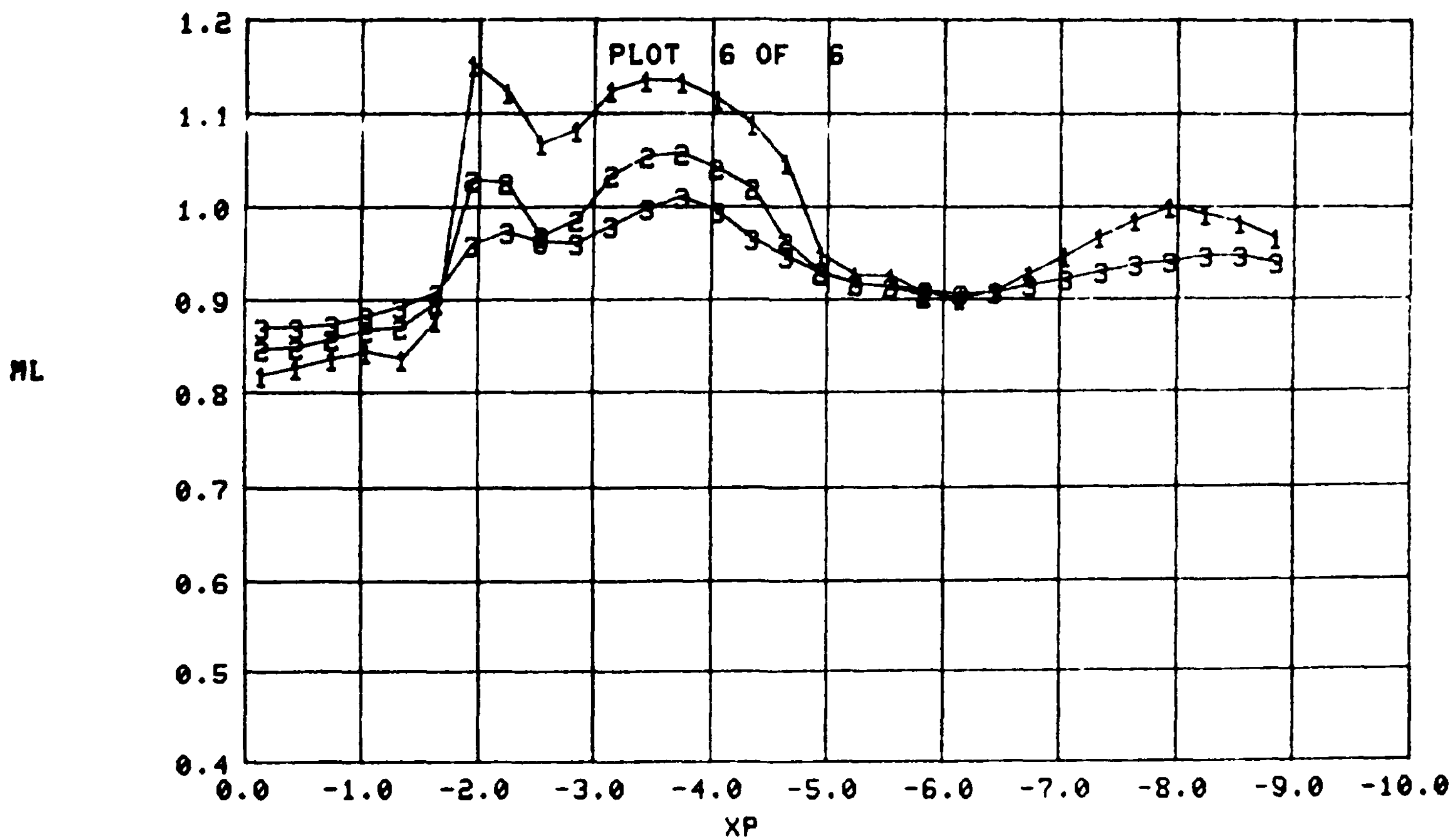
Figure 12. Continued

DATE 12-10-78 ARO INC
PROJ-P41C-F0 ARNOLD AFS,TN

** TC623 AFFDL/NWC TRANSONIC FLOW STORE TEST **

RUN = 713,714,715

RUN	SYMBOL	CONFIG	MACH	ALPHA	YP	ZP
713	1	65	0.95	5.0	0.00	0.00
714	2	65	0.95	5.0	0.00	0.35
715	3	65	0.95	5.0	0.00	0.70



1. ML vs XP, Flow-Field Phase

Figure 12. Concluded

Table 1. Wind Tunnel Nominal Test Conditions

M	PT	Q	TT	RE
0.60	2186	432	90	3.5
0.70	1975	489		
0.80	1835	539		
0.90	1741	584		
0.95	1708	604		

Table 2. Grid Aerodynamic Loads Survey Locations

		ZP/D	
XP	YP	Grid Type A	Grid Type B
0.0	0.0	0.0	0.0
		0.4	0.1
		0.8	0.2
		1.2	0.3
		1.6	0.4
		2.0	0.6
		2.4	0.8
		2.8	1.0
		3.2	1.2
		3.6	1.4
		4.0	1.6
		4.4	2.0
		4.8	2.4
		5.2	2.8
		5.6	3.2
		6.0	3.6
			4.0
			4.4
			4.8
			5.2
			5.6
			6.0

Table 3. Flow Field Survey Locations

SURVEY TYPE	INITIAL XP	FINAL XP	INCREMENT IN XP	YP	ZP
A	-0.15	-8.85	-0.30	0.00	0.00
↓	↓	↓	↓	↓	0.35
					0.70
B	-0.15	-5.85	-0.30	±0.35	0.00
↓	↓	↓	↓	↓	0.35

Table 4. Data Uncertainties

a. Aerodynamic Coefficient Uncertainties

M	ΔCN	ΔCY	ΔCAT	ΔCLM	ΔCLN	ΔCLL
0.60	±0.03	±0.03	±0.04	±0.04	±0.03	±0.01
0.70	±0.02	±0.02	±0.04	±0.04	±0.02	±0.01
0.80	±0.02	±0.02	±0.03	±0.03	±0.02	±0.01
0.90	±0.02	±0.02	±0.03	±0.03	±0.02	±0.01
0.95	±0.02	±0.02	±0.03	±0.03	±0.02	±0.01

b. Flow Field Angle Uncertainties

	ΔEPS	ΔSIG
All Mach No.	±0.25	±0.25

TABLE 5. RUN NUMBER SUMMARY

a. CAPTIVE LOADS RUN NUMBER SUMMARY

CONFIG	ALPHA*	RUN				
		M= 0.60	M = 0.70	M = 0.80	M = 0.90	M = 0.95
33	A	86		87		88
34		121				122
		126				125
36		141		142		143
37		160				161
43		81		82		83
53		77				78
54		129				130
56		136				137
57		164				165
63		97	98	99	100	101
		104	105	106	107	108
		174	170	171	172	173
64		111				112
66		146		147		148
67		153				154
83		91		92		93

*A: ALPHA = -3, -1, 1, 3, 5, 7, 9, 11, 13, 15, 17

TABLE 5. CONTINUED

b. GRID RUN NUMBER SUMMARY

CONFIG	M	ZP/D*	RUN				
			ALPHA = 1	ALPHA = 5	ALPHA = 9	ALPHA = 13	ALPHA = 17
11	0.60	A	343	344	345	346	347
	0.95		352	351	350	349	348
21	0.60		338	339	340		
31		B	300	301	302	303	304
	0.80		310	309	308	307	306
	0.95		311	312	313	314	315
32	0.60		232	233	234		
	0.95		237	236	235		
51	0.60		319	320	321		
	0.95		324	323	322		
52	0.60		219	220	221		
	0.95		229	225	224		
61	0.60		249	250	251	254	255
	0.70		258	257	256		
	0.80		260	261	262	263	264
	0.90		279	274	265		
	0.95		280	275	276	277	278
610	0.60		327				
	0.70		328				
	0.80		329				
	0.90		331				
	0.95		334				
62	0.60		240	241	242		
	0.95		245	244	243		
81	0.60		283	284	285		
	0.80		292	287	286		
	0.95		294	295	296		

*ZP/D SCHEDULES

A: ZP/D = 0, 0.4, 0.8, 1.2, 1.6, 2.0, 2.4, 2.8, 3.2, 3.6, 4.0, 4.4, 4.8, 5.2, 5.6, 6.0

B: ZP/D = 0, 0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 2.0, 2.4, 2.8, 3.2, 3.6, 4.0, 4.4, 4.8, 5.2, 5.6, 6.0,

TABLE 5. CONTINUED

c. FREESTREAM RUN NUMBER SUMMARY

CONFIG	M	ALPHAS*	RUN				
			DPHI=0.0	DPHI=22.5	DPHI=45.0	DPHI=67.5	DPHI=90.0
1	0.60	A	12	13	14	15	16
↓	0.70	↓	17	18	19	20	2[illegible]
↓	0.80	↓	22	23	24	25	26
↓	0.90	↓	27	28	29	30	31
↓	0.95	↓	32	33	34	35	36
2	0.60	↓	40				
↓	0.70	↓	41				
↓	0.80	↓	42				
↓	0.90	↓	43				
↓	0.95	↓	44				

***A: ALPHAS = -4, -2, 0, 2, 4, 6, 8, 10, 12, 14, 16**

TABLE 5. Continued

d. FLOWFIELD RUN NUMBER SUMMARY

CONFIG	M	ALPHA	XP*	RUN						
				YP = 0.0			YP = 0.35		YP = -0.35	
				ZP=0.0	ZP=0.35	ZP=0.70	ZP=0.0	ZP=0.35	ZP=0.0	ZP=0.35
15	0.60	1.0	A	956		958				
			B		957					
		5.0	A	959		961				
			B		960					
		9.0	A	962		964				
			B		963					
		13.0	A	965		967				
			B		966					
		17.0	A	968		970				
			B		969					
	0.95	1.0	A	985		987				
			B		986					
		5.0	A	973		975				
			B		974					
		9.0	A	976		978				
			B		977					
		13.0	A	979		981				
			B		980					
		17.0	A	982		984				
			B		983					
25	0.60	1.0	A	939		941				
			B		940		942		943	
		5.0	A	944		946				
			B		945		947		948	
		9.0	A	949		951				
			B		950		952		953	

* **XP SCHEDULES**

	INITIAL XP	FINAL XP	INCREMENT IN XP
A	**-0.15**	**-8.85**	**-0.30**
B	**-0.15**	**-5.85**	**-0.30**

TABLE 5. CONTINUED

e. FLOWFIELD RUN NUMBER SUMMARY

CONFIG	M	ALPHA	XP*	RUN						
				YP = 0.0			YP = 0.35		YP = -0.35	
				ZP=0.0	ZP=0.35	ZP=0.70	ZP=0.0	ZP=0.35	ZP=0.0	ZP=0.35
35	0.60	1.0	A	771		773				
↓		↓	B		772		774	775	776	777
		5.0	A	778		780				
		↓	B		779		781	782	783	784
		9.0	A	785		787				
		↓	B		786		788	789	790	791
		13.0	A	792		794				
		↓	B		793		795	796	797	798
		17.0	A	799		801				
	↓	↓	B		800		802	803	804	805
	0.80	1.0	A	806		808				
		↓	B		807		809	810	811	812
		5.0	A	820		822				
		↓	B		821		823	824	825	826
		9.0	A	827		829				
		↓	B		828		830	831	832	833
		13.0	A	835		837				
		↓	B		836		838	839	840	841
		17.0	A	842		844				
	↓	↓	B		843		845	846	847	848
	0.95	1.0	A	849		851				
		↓	B		850		852	853	854	855
		5.0	A	856		858				
		↓	B		857		859	860	861	862
		9.0	A	863		865				
↓	↓	↓	B		864		866	867	868	869

* XP SCHEDULES

	INITIAL XP	FINAL XP	INCREMENT IN XP
A	-0.15	-8.85	-0.30
B	-0.15	-5.85	-0.30

TABLE 5. CONTINUED

f. FLOWFIELD RUN NUMBER SUMMARY

CONFIG	M	ALPHA	XP*	RUN YP = 0.0 ZP=0.0	RUN YP = 0.0 ZP=0.35	RUN YP = 0.0 ZP=0.70	RUN YP = 0.35 ZP=0.0	RUN YP = 0.35 ZP=0.35	RUN YP = -0.35 ZP=0.0	RUN YP = -0.35 ZP=0.35
35	0.95	13.0	A	870		872				
			B		871		873	874	875	876
		17.0	A	877		879				
			B		878		880	881	882	883
45	0.60	1.0	A	886		888				
			B		887		889	890	891	892
		5.0	A	893		895				
			B		894		896	897	898	899
		9.0	A	900		902				
			B		901		903	904	905	906
55		1.0	A	913		915				
			B		914		916	917	918	919
		5.0	A	920		923				
			B		921/922		924	925	926	927
		9.0	A	928		930				
			B		929		931	932	933	934
65		1.0	A	597		599				
			B		598		600	601	602	603
		5.0	A	604		606				
			B		605		607	608	610	611
		9.0	A	612		615				
			B		614		616	617	619	620
		13.0	A	621		623				
			B		622		624	625	626	627
		17.0	A	663		665				
			B		664		666	667	668	669

* **XP SCHEDULES**

	INITIAL XP	FINAL XP	INCREMENT IN XP
A	-0.15	-8.85	-0.30
B	-0.15	-5.85	-0.30

TABLE 5. CONTINUED

g. FLOWFIELD RUN NUMBER SUMMARY

CONFIG	M	ALPHA	XP*	RUN YP = 0.0 ZP=0.0	RUN YP = 0.0 ZP=0.35	RUN YP = 0.0 ZP=0.70	RUN YP = 0.35 ZP=0.0	RUN YP = 0.35 ZP=0.35	RUN YP = -0.35 ZP=0.0	RUN YP = -0.35 ZP=0.35
65	0.60	1.0	A	670		672				
			B		671		673	674	675	676
		5.0	A	677		679				
			B		678		680	681	682	683
		9.0	A	684		686				
			B		685		687	688	689	690
		13.0	A	691		693				
			B		692		694	695	696	697
		17.0	A	698		700				
			B		699		701	702	703	704
	0.95	1.0	A	706		708				
			B		707		709	710	711	712
		5.0	A	713		715				
			B		714		716	717	718	719
		9.0	A	720		724				
			B		721/723		725	726	727	728
		13.0	A	729		731				
			B		730		732	733	734	735
		17.0	A	736		738				
			B		737		739	740	741	742
75	0.60	1.0	A	569		571				
			B		570		572	573	574	575
		5.0	A	576		578				
			B		577		579	580	582	583
		9.0	A	584		587				
			B		586		588	589	591	593

* **XP SCHEDULES**

	INITIAL XP	FINAL XP	INCREMENT IN XP
A	-0.15	-8.85	-0.30
B	-0.15	-5.85	-0.30

TABLE 5. CONCLUDED

h. FLOWFIELD RUN NUMBER SUMMARY

CONFIG	M	ALPHA	XP*	RUN						
				YP = 0.0			YP = 0.35		YP = -0.35	
				ZP=0.0	ZP=0.35	ZP=0.70	ZP=0.0	ZP=0.35	ZP=0.0	ZP=0.35
B5	0.60	1.0	A	745		747				
			B		746		748	749	750	751
		5.0	A	752		754				
			B		753		755	756	757/758	759
		9.0	A	760		762				
			B		761		763	764	765/766	767

* XP SCHEDULES

	INITIAL XP	FINAL XP	INCREMENT IN XP
A	-0.15	-8.85	-0.30
B	-0.15	-5.85	-0.30

Table 6. Configuration Identification

CONFIG NO	REMARKS
1	MK-83 with fins, freestream
2	MK-83 without fins, freestream

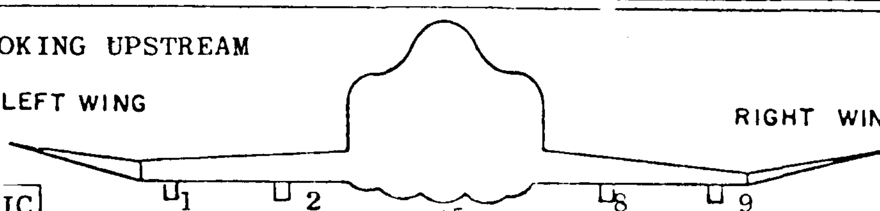
NOTE: On the Tabulated Summary Data under the heading "STORE", the following Nomenclature was used for all the configurations tested:

MK-83 F - MK-83 store metric model with fins

MK-83 UF - MK-83 store metric model without fins

TABLE 6. CONTINUED

LOOKING UPSTREAM



CONFIG. NO.	METRIC STORE / FINS	PYLONS OUTB'D (1)	PYLONS INB'D (2)	℄ (5)	PYLONS INB'D (8)	PYLONS OUTB'D (9)
11	MK-83 CTS / ON	CLEAN	● CLEAN	CLEAN	CLEAN	CLEAN
15	PRESSURE PROBE		(P.P.) CLEAN			
21	MK-83 CTS / ON		● EMPTY			
25	PRESSURE PROBE		(P.P.) EMPTY			

○ DENOTES DUMMY STORE

● DENOTES STING MOUNTED STORE

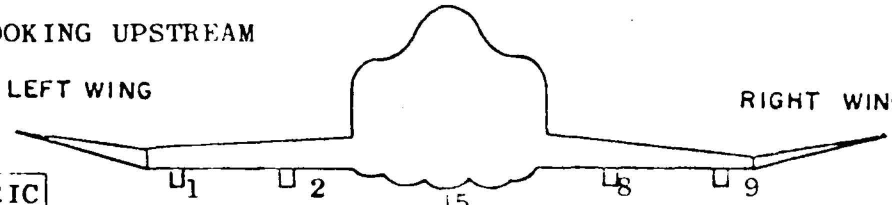
▽ - DENOTES TER

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED

LOOKING UPSTREAM



CONFIG. NO.	METRIC STORE / FINS	PYLONS OUTB'D (1)	PYLONS INB'D (2)	℄ (5)	PYLONS INB'D (8)	PYLONS OUTB'D (9)
31	MK-83 CTS / ON	CLEAN	▽ ●	CLEAN	CLEAN	CLEAN
32	MK-83 CTS / OFF		▽ ●			
33	MK-83 CAPTIVE LOADS / ON (ACTUAL AFTERBODY)		▽ ●			
34	MK-83 CAPTIVE LOADS / OFF (ACTUAL AFTERBODY)		▽ ●			

○ DENOTES DUMMY STORE

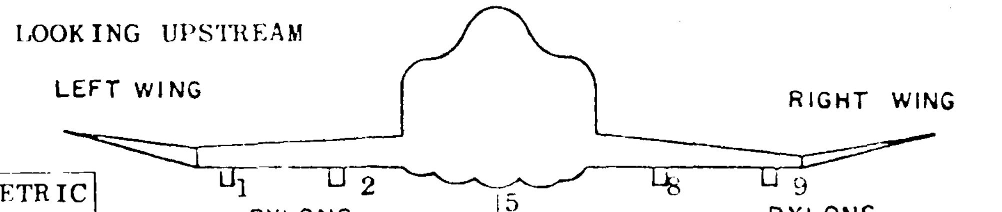
● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

▽ - DENOTES TER

TABLE 6. CONTINUED



CONFIG. NO.	METRIC STORE FINS	OUTB'D (1)	INB'D (2)	℄ (5)	INB'D (8)	OUTB'D (9)
35	PRESSURE PROBE	CLEAN	▽ (P.P.)	CLEAN	CLEAN	CLEAN
36	MK-83 CAPTIVE LOADS ON (MODIFIED AFTERBODY)		▽ ●			
37	MK-83 CAPTIVE LOADS OFF (MODIFIED AFTERBODY)		▽ ●			
43	MK-83 CAPTIVE LOADS ON (ACTUAL AFTERBODY)		○ ▽ ●			

○ DENOTES DUMMY STORE

▽ - DENOTES TER

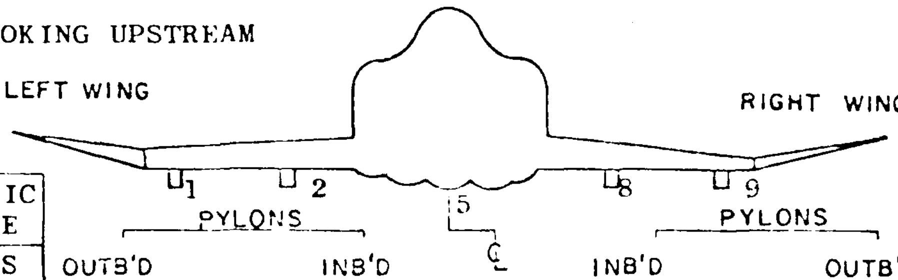
● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED

LOOKING UPSTREAM



CONFIG. NO.	METRIC STORE	FINS	OUTB'D	INB'D	℄	INB'D	OUTB'D
45	PRESSURE PROBE		CLEAN	○▽ (P.P.)	CLEAN	CLEAN	CLEAN
51	MK-83 CTS	ON		○▽○ ●			
52	MK-83 CTS	OFF		○▽○ ●			
53	MK-83 CAPTIVE LOADS	ON (ACTIVE AFTERBODY)		○▽○ ●			

○ DENOTES DUMMY STORE

▽ - DENOTES TER

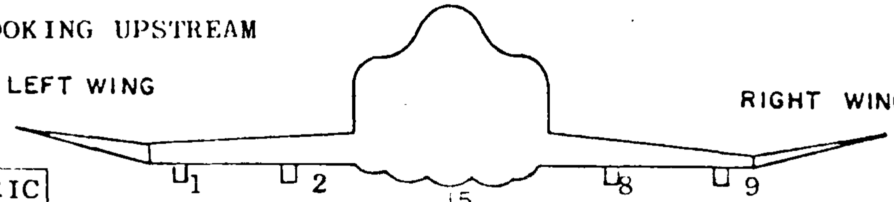
● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED

LOOKING UPSTREAM



CONFIG. NO.	METRIC STORE / FINS	PYLONS OUTB'D (1)	PYLONS INB'D (2)	℄ (5)	PYLONS INB'D (8)	PYLONS OUTB'D (9)
54	MK-83 CAPTIVE LOADS / OFF (ACTUAL AFTERBODY)	CLEAN	○▽○ ●	CLEAN	CLEAN	CLEAN
55	PRESSURE PROBE		○▽○ (P.P.)			
56	MK-83 CAPTIVE LOADS / ON (MODIFIED AFTERBODY)		○▽○ ●			
57	MK-83 CAPTIVE LOADS / OFF (MODIFIED AFTERBODY)		○▽○ ●			

○ DENOTES DUMMY STORE

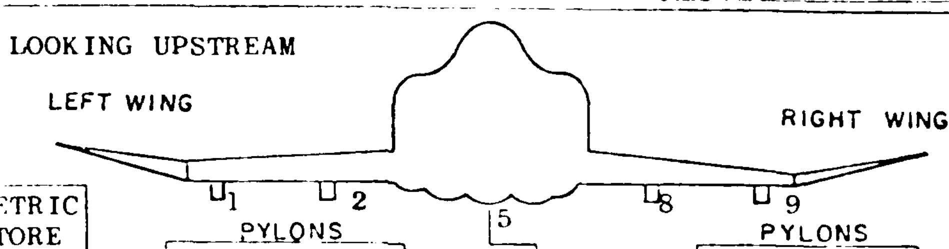
▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED



CONFIG. NO.	METRIC STORE FINS	OUTB'D	INB'D	℄	INB'D	OUTB'D
61	MK-83 CTS ON	CLEAN		CLEAN	CLEAN	CLEAN
62	MK-83 CTS OFF					
63	MK-83 CAPTIVE LOADS ON (ACTUAL AFTERBODY)					
64	MK-83 CAPTIVE LOADS OFF (ACTUAL AFTERBODY)					

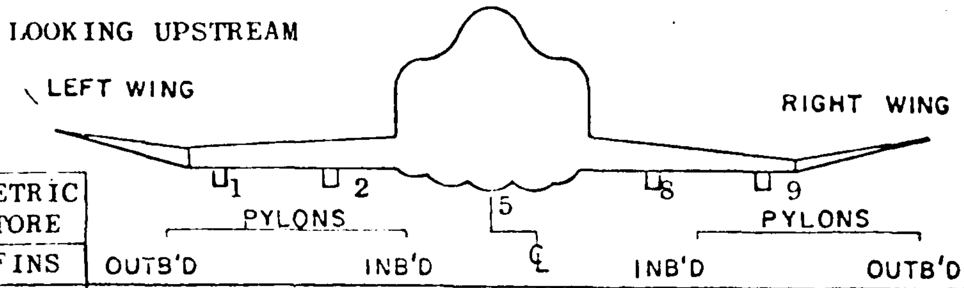
○ DENOTES DUMMY STORE ▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONTINUED



CONFIG. NO.	METRIC STORE	FINS	OUTB'D	INB'D	℄	INB'D	OUTB'D
65	PRESSURE PROBE		CLEAN	(P.P.)	CLEAN	CLEAN	CLEAN
66	MK-83 CAPTIVE LOADS	ON (MODIFIED AFTERBODY)					
67	MK-83 CAPTIVE LOADS	OFF (MODIFIED AFTERBODY)					
75	PRESSURE PROBE		EMPTY	(P.P.)	EMPTY		

○ DENOTES DUMMY STORE

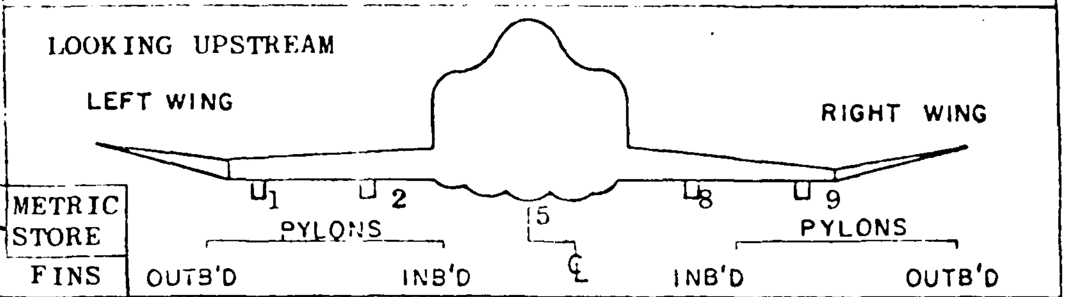
▽ - DENOTES TER

● DENOTES STING MOUNTED STORE

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 6. CONCLUDED



CONFIG. NO.	METRIC STORE / FINS	OUTB'D	INB'D	℄	INB'D	OUTB'D
81	MK-83 CTS / ON	CLEAN		CLEAN	CLEAN	CLEAN
83	MK-83 CAPTIVE LOADS / ON (ACTIVE AFTERBODY)					
85	PRESSURE PANEL		(P.P.)			

○ DENOTES DUMMY STORE

● DENOTES STING MOUNTED STORE

▽ - DENOTES TER

CLEAN DENOTES PYLON REMOVED

EMPTY DENOTES NO STORE ON PYLON

TABLE 7. Captive Aerodynamic Loads Data Tabulation Format

DATE 5-DEC-79 PROJECT NO P41C-FO
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

UNCLASSIFIED

TEST TC-623 SUMMARY 1 AFFDL/NWC TRANSONIC FLOW STORE TEST TRANSONIC 4T

RUN	M	PT	TT	Q	P	T	V	RE	TDP	SH	CONSET	ZERO SET
77	0.599	2147.6	82.7	423.6	1684.6	506.0	660.9	3.5	34.6	0.0009	12	74/ 1

A/C	CONFIG	STORE
F-4C	53	MK-83 F

PN	ALPHAS	BETAS	CN	CY	CAT	CLM	CLN	CLL	NCP	YCP	ALPHA	BETA
7	-4.23	0.04	0.634	0.277	0.282	-2.280	-0.323	-0.005	-3.597	-1.165	-2.98	0.00
11	-2.11	0.00	0.490	0.032	0.297	-1.937	0.007	0.024	-3.951	0.206	-0.89	0.00
14	-0.40	-0.02	0.386	-0.132	0.305	-1.673	0.182	0.046	-4.338	-1.382	0.79	0.00
18	1.92	-0.05	0.234	-0.332	0.297	-1.233	0.396	0.074	-5.269	-1.193	3.06	0.00
22	3.95	-0.06	0.100	-0.476	0.294	-0.934	0.453	0.083	-9.356	-0.951	5.06	0.00
26	5.98	-0.07	-0.037	-0.649	0.283	-0.522	0.550	0.088	14.130	-0.848	7.05	0.00
30	8.06	-0.10	-0.166	-0.822	0.281	-0.181	0.708	0.086	1.095	-0.862	9.09	0.00
34	10.07	-0.12	-0.210	-0.993	0.284	-0.046	0.958	0.079	0.220	-0.964	11.09	0.00
37	11.86	-0.14	-0.232	-1.112	0.279	0.049	1.080	0.077	-0.210	-0.971	12.87	0.00
40	13.85	-0.15	-0.246	-1.249	0.282	0.125	1.220	0.072	-0.509	-0.977	14.85	0.00
44	16.09	-0.17	-0.231	-1.398	0.279	0.134	1.376	0.066	-0.578	-0.985	17.09	0.00

UNCLASSIFIED

TABLE 7. CONCLUDED

DATE 5-DEC-79 PROJECT NO P41C-FO
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

UNCLASSIFIED

TEST TC-623 SUMMARY 2 AFFDL/NWC TRANSONIC FLOW STORE TEST TRANSONIC 4T

RUN	M	PT	TT	Q	P	T	V	RE	TDP	SH	CONSET	ZERO SET
77	0.599	2147.6	82.7	423.6	1684.6	506.0	660.9	3.5	34.6	0.0009	12	74/ 1

A/C	CONFIG	STORE
F-4C	53	MK-83 F

PN	ALPHA	BETA	APSE	APPE	APPE1	MNE	MDOTN	CR	VR
7	-2.98	0.00	1690.3	2119.6	2119.6	0.578	0.297	0.423	0.967
11	-0.89	0.00	1690.8	2120.6	2120.6	0.578	0.297	0.423	0.968
14	0.79	0.00	1691.1	2121.0	2121.0	0.578	0.297	0.423	0.967
18	3.06	0.00	1691.8	2121.2	2121.2	0.578	0.297	0.422	0.965
22	5.06	0.00	1692.2	2116.2	2116.2	0.574	0.295	0.420	0.960
26	7.05	0.00	1692.9	2112.3	2112.3	0.571	0.294	0.418	0.956
30	9.09	0.00	1694.3	2114.5	2114.5	0.572	0.294	0.417	0.954
34	11.09	0.00	1694.4	2119.7	2119.7	0.575	0.296	0.420	0.960
37	12.87	0.00	1692.2	2120.7	2120.7	0.577	0.297	0.421	0.965
40	14.85	0.00	1689.8	2120.9	2120.9	0.579	0.297	0.423	0.970
44	17.09	0.00	1686.5	2120.0	2120.0	0.581	0.298	0.423	0.972

UNCLASSIFIED

Table 8. Nomenclature for Captive Aerodynamic Loads Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

DATE	Calendar time at which the data were printed
PROJECT	Alpha-numeric notation for referencing a specific test project
TEST	Alpha-numeric notation for referencing a specific test program in a specific test unit

LINE 1

RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.
M	Wind tunnel free-stream Mach number
PT	Wind tunnel free-stream total pressure, psfa
TT	Wind tunnel free-stream total temperature, °F
Q	Wind tunnel free-stream dynamic pressure, psf
P	Wind tunnel free-stream static pressure, psfa
T	Wind tunnel free-stream static temperature, °R
V	Wind tunnel free-stream velocity, ft/sec
RE	Wind tunnel free-stream unit Reynolds number, millions per foot
TDP	Hygrometer dew point temperature, °F
SH	Wind tunnel specific humidity, lbm H_2O per lbm air
CON SET	Constant set used in data reduction
ZERO SET	Run/point number of the air off set of instrument readings used in data reduction

Table 8. Continued

LINE 2

A/C	Aircraft designation
CONFIG	Aircraft store loading designation
STORE	Store model designation

COLUMNAR HEADINGS

SUMMARY PAGE 1

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
ALPHAS, BETAS	Store model angle of attack and sideslip angle, respectively, deg.
CN	Normal-force coefficient
CY	Side-force coefficient
CAT	Total axial-force coefficient
CLM	Pitching-moment coefficient
CLN	Yawing-moment coefficient
CLL	Rolling-moment coefficient
NCP	Normal force center-of-pressure location, CLM/CN
YCP	Side force center-of-pressure location, CLN/CY
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg

SUMMARY PAGE 2

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg
APSE	Average measured static pressure at the engine exhaust choke exit plane, psfa

Table 8. Concluded

<u>SUMMARY PAGE 2</u> (Continued)

APPE	Average measured total pressure at the engine exhaust choke exit plane, psfa
APPE1	Calculated average total pressure at the engine exhaust choke exit plane, psfa
MNE	Duct exit Mach number
MDOTN	Engine duct mass flow rate, lbm/sec.
CR	Capture ratio, engine duct mass flow rate divided by the theoretical inlet mass flow rate
VR	Velocity ratio duct exit velocity divided by freestream velocity

TABLE 9. Grid Aerodynamic Loads Tabulation Format

DATE 4-DEC-79 PROJECT NO P41C-P0
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

RUN	SURVEY	M	PT	TT	Q	P	T	V	RE	TDP	SH	SCALF	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
229	16	0.950	1686.6	83.4	595.9	943.9	460.1	998.5	3.5	20.5	0.0027	0.050	11/17/79	1/13/47	229/ 15	228/ 1	TEST TC-623

A/C	ALPHA	BETA	IP	IY	IR	CONFIG	WING	STORE	A	L1	L2,L3	XCG	YCG	ZCG	PHIS
F-4C	1.00	0.00	-1.00	0.00	0.0	52	LEFT	MK-83 UF	1.069	1.167	1.167	4.208	0.000	0.000	0.0

SUMMARY 2

PYLON AXIS										BODY AXIS COEFFICIENTS								
PN	XP	YP	ZP/D	DPSI	DTHA	DPHI	ALPHAS	BETAS	NCP	YCP	CN	CLM	CY	CLN	CLL	CAT	NDX	RUN
19	0.00	-0.02	0.09	-0.04	-0.04	-0.0	-0.04	0.04	-4.833	3.306	0.335	-1.621	-0.149	-0.494	0.011	0.342	1	229
20	0.00	-0.03	0.14	-0.04	-0.03	-0.0	-0.03	0.04	-4.444	3.069	0.357	-1.585	-0.146	-0.447	0.011	0.343	2	229
21	0.00	-0.02	0.22	-0.01	-0.00	-0.0	-0.00	0.01	-3.872	2.746	0.366	-1.417	-0.129	-0.353	0.009	0.332	3	229
22	-0.00	-0.02	0.33	-0.01	-0.01	-0.1	-0.01	0.01	-3.491	3.079	0.349	-1.217	-0.093	-0.286	0.009	0.318	4	229
23	-0.00	-0.02	0.41	-0.01	-0.00	-0.1	-0.00	0.01	-3.411	3.383	0.325	-1.108	-0.082	-0.277	0.008	0.313	5	229
24	-0.00	-0.02	0.61	-0.02	-0.00	-0.1	-0.00	0.02	-3.295	4.249	0.267	-0.881	-0.063	-0.266	0.007	0.293	6	229
25	-0.00	-0.02	0.81	-0.02	-0.00	-0.1	-0.00	0.02	-3.327	5.115	0.227	-0.754	-0.051	-0.259	0.006	0.276	7	229
26	-0.00	-0.02	1.00	-0.02	0.00	-0.1	0.00	0.02	-3.294	5.314	0.201	-0.662	-0.046	-0.247	0.006	0.272	8	229
27	-0.00	-0.02	1.20	-0.01	0.02	-0.1	0.02	0.01	-3.338	5.464	0.177	-0.591	-0.043	-0.236	0.006	0.260	9	229
28	-0.00	-0.02	1.41	-0.02	-0.00	-0.1	-0.00	0.02	-3.408	5.552	0.157	-0.535	-0.041	-0.228	0.006	0.253	10	229
29	-0.00	-0.02	1.61	-0.02	-0.00	-0.1	-0.00	0.02	-3.497	5.411	0.141	-0.493	-0.040	-0.216	0.006	0.246	11	229
30	0.00	-0.01	1.99	-0.02	-0.00	-0.1	-0.00	0.02	-3.576	5.375	0.118	-0.422	-0.037	-0.197	0.006	0.232	12	229
31	0.00	-0.01	2.39	-0.02	0.00	-0.1	0.00	0.02	-3.628	5.050	0.102	-0.369	-0.036	-0.180	0.006	0.220	13	229
32	-0.01	-0.02	2.78	-0.01	0.01	-0.1	0.01	0.01	-3.681	4.870	0.088	-0.324	-0.034	-0.167	0.006	0.211	14	229
33	-0.01	-0.02	3.19	-0.03	-0.00	-0.1	-0.00	0.03	-3.684	4.669	0.078	-0.289	-0.033	-0.155	0.006	0.204	15	229
34	-0.01	-0.01	3.59	-0.01	0.01	-0.1	0.01	0.01	-3.662	4.640	0.070	-0.256	-0.031	-0.145	0.006	0.197	16	229
35	-0.00	-0.02	3.98	-0.02	0.00	-0.1	0.00	0.02	-3.614	4.340	0.064	-0.232	-0.031	-0.135	0.006	0.190	17	229
36	-0.01	-0.02	4.39	-0.02	0.01	-0.1	0.01	0.02	-3.619	4.549	0.057	-0.208	-0.029	-0.128	0.006	0.185	18	229
37	-0.01	-0.01	4.79	-0.02	0.01	-0.1	0.01	0.02	-3.489	4.158	0.053	-0.186	-0.029	-0.120	0.006	0.180	19	229
38	-0.00	-0.01	5.19	-0.01	0.00	-0.1	0.00	0.01	-3.350	4.432	0.050	-0.169	-0.026	-0.116	0.006	0.173	20	229
39	-0.01	-0.01	5.58	-0.01	0.01	-0.1	0.01	0.01	-3.207	4.216	0.049	-0.156	-0.026	-0.110	0.006	0.173	21	229
40	-0.00	-0.02	5.99	-0.02	-0.00	-0.1	-0.00	0.02	-3.122	4.366	0.046	-0.142	-0.024	-0.105	0.005	0.169	22	229

Table 10. Nomenclature for Grid Aerodynamic Loads Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

DATE	Calendar time at which the data were printed
PROJECT	Alpha-numeric notation for referencing a specific test project

LINE 1

RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.
SURVEY	Configuration indexing number used to correlate data with the test log. Survey may be used to identify all or portion of a grid set.
M	Wind tunnel free-stream Mach number
PT	Wind tunnel free-stream total pressure, psfa
TT	Wind tunnel free-stream total temperature, °F
Q	Wind tunnel free-stream dynamic pressure, psf
P	Wind tunnel free-stream static pressure, psfa
T	Wind tunnel free-stream static temperature, °R
V	Wind tunnel free-stream velocity, ft/sec
RE	Wind tunnel free-stream unit Reynolds number, millions per foot
TDP	Hygrometer dew point temperature, °F
SH	Wind tunnel specific humidity, lbm H_2O per lbm air
SCALE	Aircraft model scale factor
DATE	Calendar time at which data were recorded
TIME	Time at which data were recorded (hr/min/sec)
CON SET	Run/point number of constants set used in data reduction
ZERO SET	Run/point number of the air off set of instrument readings used in data reduction

Table 10. Continued

TEST	Alpha-numeric notation for referencing a specific test program in a specific test unit
<u>LINE 2</u>	
A/C	Aircraft designation
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg
IP,IY	Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg
IR	Roll incidence of the store Z_B axis at carriage with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg
CONFIG	Aircraft store loading designation
WING	Location of store launch position
STORE	Store model designation
A	Store reference area, ft^2, full scale
L1,L2,L3	Store reference lengths for pitching-moment, yawing-moment, and rolling-moment coefficients, respectively, ft, full scale
XCG	Axial distance from the store nose to the center of gravity location, ft, full scale
YCG,ZCG	Lateral and vertical distances from the store reference (balance) axis to the center of gravity location, positive in the positive Y_B and Z_B directions, respectively, ft, full scale
PHIS	Roll angle of the store Number 1 fin with respect to the $-Z_B$ axis, positive clockwise looking upstream, deg

Table 10. Continued

COLUMNAR HEADINGS

SUMMARY PAGE 2

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
XP,YP	Separation distance of the store nose with respect to the pylon-axis system origin in the X_P and Y_P directions, respectively, in, model scale
ZP/D	Separation distance of the store nose with respect to the pylon-axis system origin in the Z_P direction, calibres
DPSI	Angle between the projection of the store longitudinal axis in the X_P-Y_P plane and the X_P-axis, positive for store nose to the right as seen by the pilot, deg
DTHA	Angle between the store longitudinal axis and its projection in the X_P-Y_P plane, positive when the store nose is raised as seen by the pilot, deg
DPHI	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg
ALPHAS, BETAS	Store model angle of attack and sideslip angle, respectively, deg
NCP	Normal force center-of-pressure location, CLM/CN
YCP	Side force center-of-pressure location, CLN/CY
CAT,CN,CY	Store measured aerodynamic axial-force, normal-force, and side-force coefficients, positive in the negative X_B, negative Z_B, and positive Y_B direction, respectively
CLL,CLM,CLN	Store measured aerodynamic rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively.
Q	Wind tunnel free-stream dynamic pressure, psf
NDX	Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set

Table 10. Continued

SUMMARY PAGE 2 (Continued)

RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_B	Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all time. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

PYLON-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

X_P	Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot
Y_P	Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_P	Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Table 10. Concluded

FLIGHT-AXIS SYSTEM DEFINITIONS (GRID)

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The origin of the pylon-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.

TABLE 11. Flow-Field Data Tabulation Format.

DATE 5-DEC-79 PROJECT NO P41C-F0
ARO, INC.
AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
PROPULSION WIND TUNNEL
ARNOLD AIR FORCE STATION, TENNESSEE

RUN	SURVEY	M	PT	TT	Q	P	T	V	RE	TDP	SH	SCALE	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
900	134	0.599	2214.8	96.8	436.4	1737.8	519.2	669.0	3.5	22.6	0.0023	0.050	11/21/79	17/45/14	900/ 3	885/ 1	TEST TC-623

A/C	ALPHA	BETA	IP	IY	IR	CONFIG	WING
F-4C	9.00	0.00	-1.00	0.00	0.0	45	LEFT

SUMMARY 2

PYLON AXIS BODY AXIS FLOW ANGLES AND VELOCITIES

PN	XP	YP	ZP	ALFXY	ALFXZ	ALFYZ	VX	VXY	VXZ	VY	VYZ	VZ	PTP	QL	VL	THAT	ML	NDX	RUN
7	-8.85	-0.01	0.01	1.2	-5.0	283.4	647.0	649.4	647.1	-56.2	57.8	13.4	2213.4	415.3	649.5	5.1	0.58	1	900
8	-8.55	-0.01	0.01	1.1	-5.0	282.4	646.0	648.4	646.1	-56.7	58.1	12.5	2215.6	414.7	648.5	5.1	0.58	2	900
9	-8.25	-0.02	0.00	1.0	-5.1	281.2	645.8	648.4	645.9	-57.6	58.7	11.4	2218.3	415.1	648.4	5.1	0.58	3	900
10	-7.95	-0.01	0.00	0.9	-5.2	280.0	643.5	646.1	643.6	-58.6	59.5	10.4	2217.0	412.4	646.2	5.2	0.58	4	900
11	-7.64	-0.01	0.01	0.8	-5.4	278.6	644.4	647.2	644.5	-60.5	61.2	9.1	2218.9	413.8	647.2	5.4	0.58	5	900
13	-7.35	-0.01	0.00	0.7	-5.5	276.9	639.9	642.9	640.0	-62.0	62.5	7.6	2220.5	409.5	642.9	5.5	0.57	6	900
14	-7.05	-0.01	0.00	0.6	-5.8	275.5	636.5	639.7	636.5	-64.2	64.5	6.2	2215.9	405.2	639.7	5.7	0.57	7	900
15	-6.75	-0.01	0.01	0.5	-6.0	275.1	636.1	639.6	636.1	-67.3	67.5	6.0	2217.3	405.4	639.6	6.0	0.57	8	900
16	-6.45	-0.01	0.00	0.6	-6.3	275.0	628.8	632.6	628.8	-69.6	69.9	6.1	2217.9	398.1	632.5	6.3	0.56	9	900
17	-6.15	-0.01	-0.00	0.7	-6.7	276.3	626.3	630.6	626.4	-73.1	73.6	8.0	2216.6	395.9	630.6	6.7	0.56	10	900
18	-5.85	-0.01	0.00	1.0	-7.0	278.2	624.1	628.9	624.2	-77.1	77.9	11.1	2217.6	394.2	629.0	7.1	0.56	11	900
19	-5.55	-0.01	-0.00	1.4	-7.4	280.5	622.6	627.8	622.8	-80.9	82.3	15.1	2217.7	393.3	628.0	7.5	0.56	12	900
22	-5.25	-0.01	0.00	1.8	-7.7	283.1	617.6	623.3	618.0	-83.8	86.0	19.6	2218.4	388.8	623.6	7.9	0.56	13	900
23	-4.95	-0.01	0.00	2.2	-8.0	285.5	624.9	631.0	625.3	-88.0	91.3	24.4	2217.5	396.9	631.5	8.3	0.56	14	900
24	-4.65	-0.01	0.00	2.6	-8.2	287.5	622.2	628.5	622.8	-89.2	93.6	28.2	2211.6	393.4	629.1	8.5	0.56	15	900
25	-4.35	-0.01	0.00	2.8	-8.2	289.0	625.9	632.4	626.7	-90.3	95.5	31.1	2212.8	397.8	633.1	8.7	0.56	16	900
26	-4.05	-0.01	0.00	3.0	-8.2	289.8	633.5	640.1	634.4	-91.5	97.3	32.9	2214.6	406.5	640.9	8.7	0.57	17	900
27	-3.75	-0.01	0.00	2.8	-8.0	289.3	637.3	643.5	638.0	-89.7	95.0	31.4	2216.9	410.4	644.3	8.5	0.58	18	900
28	-3.45	-0.01	0.01	2.5	-7.7	287.9	642.5	648.4	643.1	-87.0	91.5	28.0	2216.0	415.2	649.0	8.1	0.58	19	900
29	-3.15	-0.01	0.00	2.2	-7.3	286.6	648.1	653.4	648.6	-83.2	86.8	24.8	2216.0	420.5	653.9	7.6	0.58	20	900
30	-2.85	-0.01	0.00	0.6	-7.1	275.1	636.7	641.7	636.8	-79.4	79.7	7.1	2215.1	407.4	641.7	7.1	0.57	21	900
31	-2.55	-0.01	0.00	0.3	-6.8	272.8	636.8	641.3	636.8	-75.8	75.9	3.8	2218.0	407.5	641.3	6.8	0.57	22	900
32	-2.26	-0.01	0.00	0.5	-6.4	274.7	637.8	641.8	637.8	-71.4	71.6	5.9	2218.4	407.9	641.7	6.3	0.57	23	900
35	-1.95	-0.01	-0.00	-0.2	-5.9	268.0	632.7	636.1	632.7	-65.8	65.8	-2.2	2219.7	402.2	636.0	5.9	0.57	24	900
36	-1.65	-0.01	0.01	-1.6	-5.6	254.6	611.3	614.3	611.5	-60.5	62.7	-16.6	2219.4	379.3	614.4	5.8	0.55	25	900
37	-1.35	-0.01	0.00	-0.4	-5.0	265.6	599.9	602.2	599.9	-53.0	53.1	-4.1	2221.5	366.8	602.2	5.0	0.54	26	900
40	-1.05	-0.01	0.00	1.3	-4.4	285.7	602.2	604.0	602.3	-46.7	48.5	13.1	2218.7	368.3	604.1	4.6	0.54	27	900
41	-0.75	-0.01	0.00	2.8	-3.9	305.1	603.8	605.2	604.5	-41.4	50.6	29.1	2221.9	370.7	605.9	4.8	0.54	28	900
42	-0.45	-0.01	0.00	4.3	-3.6	319.9	604.1	605.3	605.7	-38.0	58.9	45.1	2219.8	371.4	606.9	5.5	0.54	29	900
43	-0.15	-0.01	0.01	5.6	-3.6	327.0	605.6	606.8	608.4	-38.5	70.6	59.2	2221.9	374.6	609.6	6.6	0.54	30	900

Table 12. Nomenclature for Flow Field Tabulated Summary Data

PAGE HEADING (COMMON TO ALL SUMMARIES)

COMPANY HEADING

DATE	Calendar Time at which data were printed
PROJECT	Alpha-numeric notation for referencing a specific test project

LINE 1

RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.
SURVEY	Configuration indexing number used to correlate data with the test log. Survey may be used to identify all or portion of a grid set.
M	Wind tunnel free-stream Mach number
PT	Wind tunnel free-stream total pressure, psfa
TT	Wind tunnel free-stream total temperature, °F
Q	Wind tunnel free-stream dynamic pressure, psf
P	Wind tunnel free-stream static pressure, psfa
T	Wind tunnel free-stream static temperature, °R
V	Wind tunnel free-stream velocity, ft/sec
RE	Wind tunnel free-stream unit Reynolds number, millions per foot
TDP	Hygrometer dew point temperature, °F
SH	Wind tunnel specific humidity, lbm H_2O per lbm air
SCALE	Aircraft model scale factor
DATE	Calendar time at which data were recorded
TIME	Time at which data were recorded (hr/min/sec)
CON SET	Run/point number of constants set used in data reduction

Table 12. Continued

LINE 1 (Continued)

ZERO SET	Run/point number of the air off set of instrument readings used in data reduction
TEST	Alpha-numeric notation for referencing a specific test program in a specific test unit.

LINE 2

A/C	Aircraft designation
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg
IP,IY	Pitch and yaw incidence angles of the probe longitudinal axis at the initialization of the grid set with respect to the aircraft longitudinal axis, positive tip up and tip to the right, respectively, as seen by pilot, deg
IR	Roll incidence of the probe Z_B axis at the initialization of the grid set with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg
CONFIG	Aircraft store loading designation
WING	Location of probe survey

COLUMNAR HEADINGS

SUMMARY PAGE 2

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
XP	Position of the probe reference point with respect to the probe-axis system origin in the X_P direction, in, model scale
YP	Position of the probe reference point with respect to the probe-axis system origin in the Y_P direction, in, model scale

Table 12. Continued

SUMMARY PAGE 2 (Continued)

ZP	Position of the probe reference point with respect to the probe-axis system origin in the Z_P direction, in, model scale
ALFXY	Indicated angle between VXY and VX, positive for positive VY, same as SIG, deg
ALFXZ	Indicated angle between VXZ and VX, positive for positive VZ, same as EPS, deg
ALFYZ	Indicated angle between VYZ and $-Z_B$-axis, positive clockwise looking upstream, deg
VX,VY,VZ	Velocity components parallel to the probe X_B, Y_B, and Z_B axes, positive in the $-X_B$, Y_B, and $-Z_B$ directions, respectively, ft/sec
VXY,VXZ,VYZ	Velocity components in the probe body-axis X_B-Y_B, X_B-Z_B, and Y_B-Z_B planes, respectively, ft/sec
PTP	Probe measured free-stream total pressure corrected for local Mach number
QL	Local dynamic pressure, psf
VL	Local velocity, ft/sec
THAT	Angle between the local flow velocity vector and the negative X_B-axis, deg
ML	Local Mach number calculated from the ratio of the average of the four static pressures and the probe total pressure, (PS1 + PS2 + PS3 + PS4)/4(PP5)
NDX	Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set
RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.

Table 12. Continued

PROBE BODY-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_B	Parallel to the probe longitudinal axis, positive forward as seen by the pilot
Y_B	Perpendicular to the X_B anc Z_B directions, positive to the right as seen by the pilot when the probe is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the probe and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the probe is at zero pitch and roll angles

Origin

The probe reference point is the intersection of the plane containing the four static orifices and the probe centerline. The probe body-axis system origin is coincident with the probe reference point and is fixed with respect to the probe for the duration of the grid set. The X_B, Y_B and Z_B coordinate axes rotate with the probe in pitch, yaw and roll.

PROBE-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_P	Parallel to the probe longitudinal axis at the initialization of the grid set and rotated through pitch and yaw angles of IP and IY, respectively, with respect to the aircraft longitudinal axes positive forward as seen by the pilot
Y_P	Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_P	Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Table 12. Concluded

FLIGHT-AXIS SYSTEM DEFINITIONS (FLOW FIELD)

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The origin of the probe-axis and flight-axis coordinate systems was defined for this test as being the location of the MK-83 store nose tip (station 0.0) at the carriage position.